



2014 Detailed Air Quality Assessment for Greater Manchester

The Greater Manchester Combined Authority

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Summary

This Detailed Assessment for nitrogen dioxide (NO_2) has been produced on behalf of the Association of Greater Manchester Authorities (AGMA) and the Greater Manchester Combined Authority (CA) who work in partnership to co-ordinate Local Air Quality Management for ten local authorities in Greater Manchester (Bolton, Bury, Manchester, Oldham, Rochdale, Salford, Stockport, Tameside, Trafford, and Wigan). The Greater Manchester CA has statutory powers for Local Air Quality Management (LAQM) under Sections 82 to 84 of the Environment Act 1995.

The report provides a review of NO_2 monitoring data from AGMA Authorities and presents results from the Greater Manchester Emissions Dispersion Model (GMEDIS) NO_2 modelling study undertaken by Transport for Greater Manchester (TfGM), which is subject to a separate report.

The Detailed Assessment follows a 2012 Updating and Screening Assessment (USA) for Greater Manchester, which was the first air quality assessment report of the Greater Manchester CA. The conclusions of the 2012 USA were that nitrogen dioxide measurements from a range of automatic stations in different districts showed broad agreement with the respective AQMA designations, but more widespread passive diffusion tube data suggested that the current AQMA required review.

A comprehensive atmospheric emissions inventory for the Greater Manchester area was compiled at the onset of the LAQM regime, which has been revised and updated periodically since 1997. The latest version of the inventory was established on a base year of 2010 but incorporated road transport and industrial emission source projections to 2016, and this formed the basis of the predictive modelling study.

The GMEDIS model results indicate that exceedances of the NO_2 long and short term Objectives are unlikely outside the existing AQMA boundary. The highest concentrations of NO_2 are predicted to be within the AQMA and in close proximity to motorways, major roads, town and city centres.

The modelling results also indicate that NO_2 concentrations have decreased across Greater Manchester since the AQMA was declared, with the existing AQMA boundary set at $35 \mu\text{g.m}^{-3}$ covering a much larger area than that predicted to exceed $35 \mu\text{g.m}^{-3}$ in 2016.

The analysis of continuous and passive diffusion tube NO_2 monitoring data over a 5-year period from 2009 to 2013, and a detailed predictive modelling study using a 2010 base year and a 2016 scenario, both indicate that the geographical extent of exceedances of the NO_2 Objective has decreased since the latest Greater Manchester AQMA was designated. The conclusion is that the boundary will be reduced back to the key road network sources in accordance with the modelled concentrations.

Table of Contents

Summary

Summary	3
---------------	---

Table of Contents	4
-------------------------	---

1 Introduction	1
----------------------	---

1.1 Project Background	2
1.2 Legislative Background	2
1.2.1 European Standards for Air Quality	2
1.2.2 National Legislation and Standards on Air Quality	2
1.2.3 Local Air Quality Management	3
1.3 Greater Manchester Air Quality Management Area (AQMA).....	5
1.4 Summary of Greater Manchester Air Quality Review and Assessment.....	5

2 Methodology	6
---------------------	---

2.1 Data Sources.....	7
2.2 Greater Manchester Air Quality Monitoring	7
2.3 Dispersion Modelling	7
2.3.1 Emissions modelled	8
2.3.2 Meteorological Data	8
2.3.3 Background Concentrations	8
2.3.4 Emission Factors.....	8
2.3.5 Model Areas	8
2.3.6 Monin-Obukhov Length	8
2.3.7 Surface roughness	8
2.3.8 Conversion of NO _x to NO ₂	9
2.3.9 Receptor Locations	9
2.3.10 Model Uncertainty	9
2.3.11 Model Verification.....	9

3 Greater Manchester Air Quality Monitoring	10
---	----

3.1 Air Quality Monitoring	11
3.1.1 Results from Automatic Monitoring Sites.....	12
3.1.2 Results from NO ₂ Diffusion Tube Sites	16

4 Air Quality Modelling Results	21
4.1 Predicted NO ₂ concentrations at specified points.....	22
4.2 Predicted NO ₂ concentrations across Greater Manchester	23
5 Conclusions	26
Appendix A.....	32
Appendix A: Monitoring Data Quality Assurance and Control	33
Appendix B.....	56
Appendix B: Model Uncertainty.....	57
Appendix B: Model Verification.....	60
Appendix B: Predicted NO ₂ concentrations 2010 and 2016.....	70

NOTICE

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1 Introduction

Introduction

1.1 Project Background

This Detailed Assessment for nitrogen dioxide (NO_2) has been produced on behalf of the Association of Greater Manchester Authorities (AGMA) and the Greater Manchester Combined Authority (CA) who work in partnership to co-ordinate Local Air Quality Management for ten local authorities in Greater Manchester (Bolton, Bury, Manchester, Oldham, Rochdale, Salford, Stockport, Tameside, Trafford, and Wigan). The Greater Manchester CA has statutory powers for Local Air Quality Management (LAQM) under Sections 82 to 84 of the Environment Act 1995.

A contiguous Air Quality Management Area (AQMA) has been designated across the ten Greater Manchester boroughs, declared independently by each Authority between 2001 and 2007. A 2012 Air Quality Updating and Screening Assessment (USA) for the Greater Manchester CA reported that air quality Objectives were likely to be achieved in each authority in respect of all prescribed pollutants except NO_2 . It concluded and that a Detailed Assessment was required to determine the extent of exceedences of the annual average and hourly NO_2 Objectives, as monitored annual mean NO_2 concentrations were below $40\mu\text{g.m}^{-3}$ at some diffusion tube monitoring sites within the AQMA, and above $35\mu\text{g.m}^{-3}$ at some sites outside the AQMA.

This report provides a review of NO_2 monitoring data from AGMA Authorities and presents results from the Greater Manchester Emissions Dispersion Model (GMEDIS) NO_2 modelling study undertaken by Transport for Greater Manchester (TfGM) for this Detailed Assessment. The extent of exceedences of the annual average and hourly NO_2 Objectives across the AGMA Authorities are established.

1.2 Legislative Background

1.2.1 European Standards for Air Quality

Air pollution can have adverse effects on the health of humans and ecosystems. European Union (EU) legislation forms the basis for UK air quality policy. The EU Air Quality Framework Directive 96/62/EC on Ambient Air Quality Assessment and Management entered into force in September 1996¹. This was a framework for tackling air quality through setting European-wide air quality limit values in a series of daughter directives, prescribing how air quality should be assessed and managed by the Member States. Directive 96/62/EC and the first three daughter Objectives were combined to form the new EU Directive 2008/50/EC² on Ambient Air Quality and Cleaner Air for Europe, which came into force June 2008.

1.2.2 National Legislation and Standards on Air Quality

The 1995 Environment Act³ required the preparation of a national Air Quality Strategy (AQS) which set air quality standards and Objectives for specified pollutants. The Act also outlined measures to be taken by local planning authorities (LPAs) in relation to meeting these standards and Objectives.

The UK AQS was originally adopted in 1997⁴ and has been reviewed and updated in order to take account of the evolving EU Legislation, technical and policy developments and the latest information on health effects of air pollution. The strategy was revised and reissued in 2000 as the AQS for England, Scotland, Wales and Northern Ireland⁵. This was subsequently amended in 2003⁶ and was last updated in July 2007⁷.

¹ European Parliament (1996) *Council Directive 96/62/EC on Ambient Air Quality Assessment and Management*.

² European Parliament (2008) *Council Directive 2008/50/EC on Ambient Air Quality and Cleaner Air for Europe*.

³ HMSO (1995) *'The Environment Act 1995 (c.25)*', London:TSO.

⁴ Department of the Environment (DoE) (1997) *'The UK National Air Quality Strategy'*, London: HMSO.

⁵ Department of the Environment, Transport & the Regions (DETR) (2000) *'UK Air Quality Strategy'*. London:HMSO.

⁶ DETR (2003) *'UK Air Quality Strategy- Addendum'*. London:HMSO.

⁷ Department for Environment, Food and Rural Affairs (Defra) (2007) *'The Air Quality Strategy for England, Scotland, Wales and Northern Ireland'*, London:HMSO.

Introduction

1.2.3 Local Air Quality Management

Local authorities are required under the 1995 Environment Act and subsequent regulations (the Air Quality (England) Regulations (2000)⁸, and the Air Quality (England) (Amendment) Regulations 2002⁹, and the Air Quality Standards Regulations 2010)¹⁰) to review and assess air quality in their area under the system of Local Air Quality Management (LAQM).

The duty of the local authority review and assessment process is to identify all those areas where the air quality Objectives are being or are likely to be exceeded. There is a phased approach to the LAQM process involving Updating and Screening Assessments, Detailed Assessments, Progress Reports, and Further Assessments, as described in Table 1-1. Local authorities will no longer be required to carry out separate Further Assessments as these are to be rescinded via Part 4 of Schedule 13 of the Deregulation Act 2015..

Table 1-1: The Phased Approach to Review and Assessment

Level of Assessment	Objective
Updating and Screening Assessment	To identify those matters that have changed since the last Review and Assessment, which might lead to a risk of an air quality objective being exceeded.
Detailed Assessment	To provide an accurate assessment of the likelihood of an air quality objective being exceeded at locations with relevant exposure. This should be sufficiently detailed to allow the designation or amendment of any necessary AQMAs.
Progress Report	To maintain continuity in the LAQM process and fill in the gaps between the three yearly cycle of Review and Assessment.
Further Assessment	To supplement information provided in the Detailed Assessment. It should confirm the exceedence of the objectives; define what improvements in air quality and corresponding reduction in emissions is required to attain the objectives; and provide information on source contributions. [To be rescinded]

The current air quality standards and Objectives (for the purpose of LAQM) are outlined in Table 1-2. Pollutant standards relate to ambient pollutant concentrations in air, set on the basis of medical and scientific evidence of how each pollutant affects human health. Pollutant Objectives however incorporate future dates by which each standard is to be achieved, taking into account economic considerations, practicability and technical feasibility.

Where an air quality Objective is unlikely to be met by the relevant deadline, local authorities must designate those areas as Air Quality Management Areas (AQMAs) and take action, along with others, to work towards meeting the Objectives. Following the designation of an AQMA, local authorities are required to develop an Air Quality Action Plan (AQAP) to work towards meeting the Objectives and improve air quality locally.

Possible exceedences of air quality Objectives are usually assessed in relation to those locations where members of the public are likely to be regularly present and are likely to be exposed for a period of time appropriate to the averaging period of the Objective.

⁸ HMSO (2000) 'Statutory Instrument 2000 No. 928, The Air Quality (England) Regulations 2000', London:HMSO.

⁹ HMSO (2002) 'Statutory Instrument 2002 No. 3043, The Air Quality (England) (Amendment) Regulations 2002', London:HMSO.

¹⁰ HMSO (2010) 'Statutory Instrument 2010 No. 1001, Air Quality Standards (England) Regulations, 2010'. London:HMSO.

Introduction

Table 1-2: Air Quality Strategy Objectives (England) for the Purpose of Local Air Quality Management

Pollutant	Air Quality Objective		To be achieved by
	Concentration	Measured as*	
Benzene	5 $\mu\text{g.m}^{-3}$	Annual mean	31/12/2010
1,3 Butadiene	2.25 $\mu\text{g.m}^{-3}$	Running annual mean	31/12/2003
Carbon monoxide	10 mg.m^{-3}	Maximum daily running 8-hour mean	31/12/2003
Lead	0.25 $\mu\text{g.m}^{-3}$	Annual mean	31/12/2008
Nitrogen dioxide (NO ₂)	200 $\mu\text{g.m}^{-3}$	1 hour mean not to be exceeded more than 18 times per year	31/12/2005
	40 $\mu\text{g.m}^{-3}$	Annual mean	31/12/2005
Particles (PM ₁₀)	50 $\mu\text{g.m}^{-3}$	24-hour mean not to be exceeded more than 35 times per year	31/12/2004
	40 $\mu\text{g.m}^{-3}$	Annual mean	31/12/2004
Particles (PM _{2.5})	25 $\mu\text{g.m}^{-3}$	Annual mean (target)	2020
	15% cut in annual mean (urban background exposure)		2010 - 2020
Sulphur Dioxide (SO ₂)	350 $\mu\text{g.m}^{-3}$	1-hour mean not to be exceeded more than 24 times a year	31/12/2004
	125 $\mu\text{g.m}^{-3}$	24-hour mean not to be exceeded more than 3 times a year	31/12/2004
	266 $\mu\text{g.m}^{-3}$	15-minute mean not to be exceeded more than 35 times a year	31/12/2005

Note: * how the Objectives are to be measured is set out in the UK Air Quality (England) Regulations (2000).

Introduction

1.3 Greater Manchester Air Quality Management Area (AQMA)

In 2001 the Greater Manchester Authorities declared separate AQMAs across the ten constituent boroughs, for exceedances of the annual mean Objective for NO₂ and the 24-hour Objective for PM₁₀. Some of these AQMAs were amended between 2005 and 2007 following detailed air quality assessments undertaken in 2004 which reported continued exceedance of the annual mean air quality Objective for NO₂ close to busy roads, but no exceedances of the PM₁₀ air quality Objectives across Greater Manchester. The current combined AQMA is designated for NO₂ only and is shown in Figure 1. The AQMA boundary was declared where modelled concentrations exceeded 35 $\mu\text{g.m}^{-3}$, based on a conservative interpretation of an Objective 'likely' to be exceeded.

1.4 Summary of Greater Manchester Air Quality Review and Assessment

The latest air quality review and assessment report available for Greater Manchester is the 2012 Air Quality Updating and Screening Assessment (USA) (the first air quality assessment report of the Greater Manchester CA). The conclusions of the 2012 USA are provided below.

Conclusions from New Monitoring Data

There are nearly 300 nitrogen dioxide diffusion tubes sites in the Greater Manchester diffusion tube network that have been operating over a long period of time. Approximately 25% of tubes marked as being inside the AQMA are less than 35 $\mu\text{g/m}^3$, (the threshold for the AQMA). Around 5% of tubes greater than or equal to 35 $\mu\text{g/m}^3$ are located outside the AQMA.

Nitrogen dioxide measurements from the automatic stations broadly agree with their respective AQMA designation. Stockport and Oldham (now closed) stations are in the AQMA but had results less than 35 $\mu\text{g/m}^3$.

Diffusion tube data suggests that the current AQMA requires reviewing and Greater Manchester is undertaking dispersion modelling.

Particulate matter (less than 10 microns) annual averages are not exceeded and have a downward trend. No sites had more than 35 occurrences of the daily mean and therefore the air quality objective was met.

Conclusion from Assessment of Sources

Automatic assessment of roads by TfGM identified a large number potential links requiring assessment by DMRB. Many of these would have been previously assessed and eliminated in earlier reports, identifying these links is difficult and as dispersion modelling was in progress, deferred until then. Detailed dispersion modelling of Greater Manchester will provide information on concentrations of nitrogen dioxide and particulate matter at roadside locations for assessment against the air quality objectives.

There are no new or significantly changed sources that could lead to potential exceedance identified within Greater Manchester.

(where TfGM is Transport for Greater Manchester, and DMRB is the Design Manual for Roads and Bridges).

2 Methodology

Methodology

2.1 Data Sources

The assessment was undertaken with reference to the results of the Greater Manchester Emissions Dispersion Model (GMEDIS) NO₂ modelling study undertaken by Transport for Greater Manchester (TfGM), and information from a number of other sources, as detailed in Table 2-1.

Table 2-1 Key Information Sources

Data Source	Reference
Department for the Environment Food and Rural Affairs (Defra)	Defra (2009) <i>Local Air Quality Management Technical Guidance TG (09)</i> .
Association of Greater Manchester Authorities	GMTU Report 1625, September 2010. <i>The Greater Manchester Emissions Dispersion Model</i>
Greater Manchester Combined Authority (GMCA)	GMCA (October 2013) 2012 Air Quality Updating and Screening Assessment for Greater Manchester.
Greater Manchester Transportation Unit (GMTU)	GMTU (December 2013) <i>The Greater Manchester Emissions Dispersion Model – 2010 Model Year HFAS Report 1786, DRAFT</i> .
Transport for Greater Manchester (TfGM)	TfGM (June 2013), <i>The Greater Manchester Emissions Inventory 2010 Update, HFAS Report 1750</i> .
Transport for Greater Manchester (TfGM)	TfGM (February 2014), <i>The Greater Manchester Emissions Dispersion Model – 2016 Model Year HFAS Report 1794</i> .

2.2 Greater Manchester Air Quality Monitoring

2009 to 2013 data from automatic and passive monitoring sites in each of the ten AGMA authorities was reviewed to determine the extent of exceedances of the annual average and hourly NO₂ Objectives. Passive monitoring data for the AGMA authorities was obtained from Salford City Council; automatic monitoring data was obtained from the GreatAir Manchester website¹¹. Details of air quality monitoring data management (quality assurance and quality control) are provided in Appendix A.

2.3 Dispersion Modelling

Detailed dispersion modelling of NO₂ for this Detailed Assessment was undertaken by TfGM using the dispersion model ADMS-Urban v2.3. ADMS-Urban is a comprehensive tool for modelling the atmospheric dispersion of pollutants released from industrial, domestic, and road traffic sources in urban areas, and its algorithms and outputs have been verified in a large number of studies (see www.cerc.co.uk/).

The 2013 and 2014 GMTU reports on the Greater Manchester Emissions Dispersion Model (GMEDIS)^{12, 13} provide detailed information on the model construction, calibration and verification. A summary of key model inputs are provided below.

¹¹ <http://www.greatairmanchester.org.uk>

¹² GMTU (December 2013) *The Greater Manchester Emissions Dispersion Model – 2010 Model Year HFAS Report 1786, DRAFT*.

¹³ TfGM (February 2014), *The Greater Manchester Emissions Dispersion Model – 2016 Model Year HFAS Report 1794*.

Methodology

Assessment Scenarios

The dispersion modelling study considered the following scenarios:

- Scenario 1 – Base Year (2010); and
- Scenario 2 – Future Year (2016).

2.3.1 Emissions modelled

Emissions of NO₂ from point, line and area sources were included in the GMEDIS model. All data for inclusion in the 2010 model scenario were taken from the Emissions Inventory for Greater Manchester (EMIGMA) 2010 update¹⁴, with the exception of point source and stack data which were taken from the EMIGMA 2006 update¹⁵ and modified as outlined in the GMEDIS 2010 Model Report¹⁶. For the 2016 scenario road source emissions were taken from a 2016 EMIGMA emissions forecast and point source data were revised in accordance with individual authority advice on likely future operations¹³.

EMIGMA is a comprehensive emissions inventory which was first compiled at the onset of the LAQM regime, and has been revised and updated periodically since its first publication in 1997. The 2010 database covers an area of 1272 km² encompassing the ten administrative districts of Greater Manchester. The major roads update made use of traffic speed and flow data from the 2010 Greater Manchester SATURN Model, and the regulated industries point source release data were updated in accordance with permits and monitoring information as appropriate. The database also includes large and medium combustion plant (> 2MWth), land based emissions as well as other area source estimates such as domestic / commercial activities. Thus, rather than model conventional road vehicle emission effects and add these to an assumed existing background pollutant concentration, the wider model incorporated all key emission sources and projected dispersion algorithms were used to determine the resulting combined pollutant concentration distributions.

2.3.2 Meteorological Data

2010 meteorological data from the Manchester Airport meteorological station was used in the ADMS-Roads model.

2.3.3 Background Concentrations

The ADMS-Urban v2.3 model requires background nitrogen oxide (NO_x), NO₂, and ozone (O₃) concentrations to determine the predicted NO_x to NO₂ relationship, using the chemical reaction scheme module in the model. 2010 background NO_x, NO₂, and O₃ concentrations were taken from the Glazebury rural automatic monitoring site (with missing O₃ data from a monitoring site at Ladybower in Derbyshire).

2.3.4 Emission Factors

All emission factors used are provided in the Greater Manchester EMIGMA 2010 update report¹⁴.

2.3.5 Model Areas

In total 49 modelling areas were created across Greater Manchester, the majority of which were 5km x 5km.

2.3.6 Monin-Obukhov Length

A minimum Monin-Obukhov length of 30m was selected to represent the stability of the atmosphere due to the characteristics of the urban areas.

2.3.7 Surface roughness

¹⁴ Transport for Greater Manchester, June 2013, *The Greater Manchester Emissions Inventory 2010 Update*, HFAS Report 1750.

¹⁵ GMTU, July 2009, *The Greater Manchester Emissions Inventory 2009 Update*, GMTU Report 1530

¹⁶ Transport for Greater Manchester, December 2013, *The Greater Manchester Emissions Dispersion Model – 2010 Model Year*, HFAS Report 1786

Methodology

A surface roughness length of 0.5m was assigned in the model for the area.

2.3.8 Conversion of NO_x to NO₂

The conversion of NO_x to NO₂ was undertaken using the chemical reaction scheme module of ADMS-Urban v2.3 (i.e. predictions of NO₂ were provided by the model).

2.3.9 Receptor Locations

Pollutant concentrations were calculated using a receptor grid with a grid spacing of 50m x 50m (some areas used a slightly larger grid spacing). In addition, ADMS intelligent gridding was used to increase the number of receptors close to roads in order to improve resolution where the gradient of concentrations is high. 2093 individual receptors were selected, including monitoring sites and sensitive receptor locations, as advised by the constituent local authorities.

2.3.10 Model Uncertainty

Performance of the GMEDIS model was evaluated using statistical procedures following Defra guidance^{17,18} and model performance was found to be acceptable, with an r value of 0.978 and overall standard deviation of 3.60. The uncertainty calculations are detailed in Appendix B.

2.3.11 Model Verification

The ADMS-Urban model was used to predict NO₂ directly and a comparison of modelled and monitored Total NO₂ concentrations (from automatic and diffusion tube monitoring sites) was made following Defra guidance¹⁸ (Box A3.5 of TG.09 (Appendix A3)). The comparison of modelled and monitored Total NO₂ concentrations is shown in Appendix B. The majority of modelled results were within 25% of monitored concentrations and therefore model results were not adjusted.

¹⁷ Defra, June 2010, *Evaluating the Performance of Air Quality Models Issue 3*.

¹⁸ Defra, February 2009, *Local Air Quality Management Technical Guidance LAQM.TG.(09)*.

3 Greater Manchester Air Quality Monitoring

Greater Manchester Air Quality Monitoring

3.1 Air Quality Monitoring

The ten Greater Manchester Authorities currently undertake ambient monitoring of NO₂ across their administrative areas using passive NO₂ diffusion tube sites and automatic analysers. NO₂ monitoring sites by Local Authority are described in Table 3-1 (diffusion tubes) and Table 3-2 (automatic analysers).

Table 3-1 Summary of Greater Manchester NO₂ diffusion tube monitoring sites by type (2013)

Local Authority	Site Type							
	Kerbside	Roadside	Rural	Suburban	Urban Background	Urban Centre	Not Classified	Total
Bolton	2	7	0	0	14	1	0	24
Bury	2	4	0	0	3	0	1	10
Manchester	12	7	0	4	9	6	0	38
Oldham	1	2	0	0	4	0	0	7
Rochdale	0	9	1	0	4	2	0	16
Salford	2	21	0	0	10	0	0	33
Stockport	0	11	2	0	15	1	0	29
Tameside	0	23	0	3	6	0	9	41
Trafford	2	4	1	0	3	6	0	16
Wigan	1	65	0	0	5	1	1	73
TOTAL	22	153	4	7	67	23	11	287

Table 3-2 Summary of Greater Manchester NO₂ automatic monitoring sites by type

Local Authority	Automatic Monitoring Site	Type	Within AQMA
Bolton	Bolton College~	Urban Background	No
Bury	Bury Roadside*	Roadside	Yes
Bury	Bury Prestwich	Roadside	Yes
Bury	Bury Radcliffe	Roadside	Yes
Salford	Glazebury	Rural	No
Salford	Salford M60	Roadside	Yes
Salford	Eccles	Urban Industrial	Yes
Manchester	Manchester Piccadilly	Urban Centre	Yes
Manchester	Manchester South	Suburban	No
Manchester	Manchester Oxford Road	Kerbside	Yes
Wigan	Wigan Centre	Urban Background	No
Wigan	Wigan Leigh 2*	Urban Background	No
Oldham	Oldham West End House~	Urban Centre	Yes
Stockport	Stockport Hazel Grove	Roadside	Yes
Stockport	Stockport Shaw Health~	Urban Background	Yes

Greater Manchester Air Quality Monitoring

Local Authority	Automatic Monitoring Site	Type	Within AQMA
Tameside	Tameside Two Trees School	Urban Background	No
Tameside	Mottram Moor	Roadside	
Trafford	Trafford	Urban Background	No
Trafford	Trafford A56	Roadside	Yes

~Site closed in 2011 *Site closed in 2012, ^Site closed in 2013

3.1.1 Results from Automatic Monitoring Sites

LAQM TG (09) advises that '*only if acceptable data quality and high capture rates are achieved can the performance be regarded as fully satisfactory. A data capture rate of 90% for ratified data is specified in the relevant EC Directives and is recommended as a target for automatic monitoring*'.

Inside the AQMA

Between 2009 and 2013 there have been 11 automatic monitoring sites operating within the AQMA, and results from these sites are shown in Table 3-5, Table 3-6 and Graph 3-1. Three of these sites closed in 2012 / 2013.

Averaged annual mean NO₂ concentrations between 2009 and 2013 from automatic monitoring sites within the AQMA were above the annual mean Objective at six sites, four of which were roadside (Bury Roadside, Bury Prestwich, Salford M60, and Trafford A56), one urban centre (Manchester Piccadilly), and one kerbside (Manchester Oxford Road). Concentrations were below the Objective at five sites, two of which were roadside (Bury Radcliffe and Stockport Hazel Grove), one urban background (Stockport Shaw Heath), one urban industrial (Salford Eccles), and one urban centre (Oldham West End House) (Table 3-5).

Table 3-3: Annual Mean NO₂ µg.m⁻³ at Greater Manchester Automatic monitoring sites inside the AQMA (including three sites which closed between 2011 and 2013).

Local Authority	Automatic Monitoring Site	Type	2009	2010	2011	2012	2013	Avg. 2009-2013
Bury	Bury Roadside*	RO	72 [#]	69	71 [#]	56(57 [^])	~	67
Bury	Bury Prestwich	RO	N/A	N/A	46	48 [#]	45	46
Bury	Bury Radcliffe	RO	N/A	N/A	30	28 [#]	26	28
Salford	Salford M60	RO	70	60	64	62	61 [#]	63
Salford	Eccles	UI	39 ⁺	42 [#]	33 [#]	28 [#]	30	34
Manchester	Manchester Piccadilly	UC	42	45	44	41 [#]	39	42
Manchester	Manchester Oxford Road	KE	N/A	64 [#]	66	62	55 [#]	62
Oldham	Oldham West End House~	UC	30	33	33	~	~	32
Stockport	Stockport Hazel Grove	RO	31 [#]	36 ⁺	24 [#]	29	30	30
Stockport	Stockport Shaw Heath~	UB	27	31	44[31 [^]]	~	~	34
Trafford	Trafford A56	RO	44	46	41	49	47[39 ⁺]	45
Annual Mean NO₂ air quality Objective				40 µg.m⁻³				

~Site closed in 2011 *Site closed in 2012, ^Site closed in 2013 # Data capture 75-90%, + Data capture less than 75%, [A] annualised data

Greater Manchester Air Quality Monitoring

The hourly NO₂ Objective was not exceeded at any of the Greater Manchester Automatic Monitoring Sites within the AQMA between 2011 and 2013. The short-term Objective was breached in 2010 at the Bury Roadside site (where 23 hourly exceedences of 200 µg.m⁻³ were recorded), and in 2009 at the Salford M60 site (with 106 hourly exceedences, although analyser reliability was reported to be uncertain and the data are thought to be flawed), as shown in Table 3-4.

Table 3-4: Number of exceedences of NO₂ Hourly mean >200 µg.m⁻³ at Greater Manchester Automatic monitoring sites inside the AQMA (including three sites which closed between 2011 and 2013).

Local Authority	Automatic Monitoring Site	Type	2009	2010	2011	2012	2013
Bury	Bury Roadside*	RO	11	23	7	10	
Bury	Bury Prestwich	RO	Not open	Not open	0	0	0
Bury	Bury Radcliffe	RO	Not open	Not open	0	0	0
Salford	Salford M60	RO	106	13	13	8	4
Salford	Eccles	UI	0	15	0	2	0
Manchester	Manchester Piccadilly	UC	0	0	0	0	0
Manchester	Manchester Oxford Road	KE	Not open	2	5	13	0
Oldham	Oldham West End House~	UC	0	0	0	~	~
Stockport	Stockport Hazel Grove	RO	0	4	0	0	0
Stockport	Stockport Shaw Health~	UB	0	5	0	~	~
Trafford	Trafford A56	RO	0	12	0	14	7
1 Hour Mean 200µg.m⁻³				Not to be exceeded more than 18 times per year			

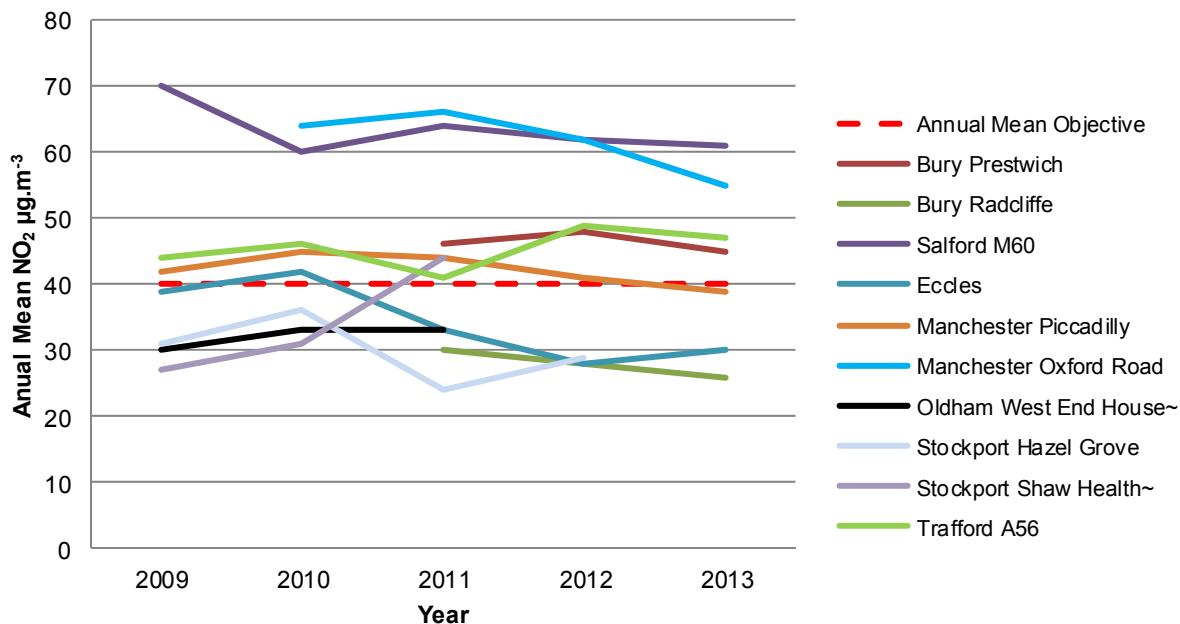
~Site closed in 2011 *Site closed in 2012

The general trend is that annual mean NO₂ concentrations decreased between 2009 and 2013 at the majority of automatic monitoring sites within the AQMA with the exception of one roadside site (Trafford A56), and one urban industrial site (Salford Eccles) where concentrations increased slightly between 2012 and 2013 (Graph 3-1).

In 2013 a data capture rate of above 90% was achieved at four of the eight of the automatic monitoring sites operating within the AQMA. 2013 annual mean NO₂ concentrations were below the annual mean NO₂ Objective at three of these sites (Bury Radcliffe, Salford Eccles, and Manchester Piccadilly) and above the Objective at one site (Bury Prestwich). Annualised data for the Trafford A56 station indicates an annual mean just below the Objective.

Greater Manchester Air Quality Monitoring

Graph 3-1 Annual Mean NO₂ µg.m⁻³ at Greater Manchester Automatic monitoring sites within the AQMA



Outside the AQMA

Between 2009 and 2013 there have been eight automatic monitoring sites outside the AQMA, and results from these sites are shown in Table 3 5, Table 3 6 and Graph 3 2. Two of these sites closed in 2012 and 2013.

Averaged annual mean NO₂ concentrations between 2009 to 2013 from automatic monitoring sites outside the AQMA were below the annual mean Objective at all sites.

The hourly NO₂ Objective has not been exceeded at any of the Greater Manchester automatic monitoring sites outside the AQMA since 2009 (with the exception of the Trafford site where 18 exceedences were recorded in 2010) (Table 3-6).

Greater Manchester Air Quality Monitoring

Table 3-5: Annual Mean NO₂ µg.m⁻³ at Greater Manchester Automatic monitoring sites outside the AQMA (including two sites which closed between 2012 and 2013).

Local Authority	Automatic Monitoring Site	Type	2009	2010	2011	2012	2013	Avg. 2009-2013
Tameside	Tameside Two Trees School	UB	19 [#]	24 ⁺	21 [#]	19	18[17 ^A] ⁺	20
Tameside	Mottram Moor		Not open	Not open	Not open	Not open	37[35 ^A] ⁺	37
Trafford	Trafford	UB	34	33	26	26 [#]	22 [#]	28
Bolton	Bolton College~	UB	27 [#]	28	40[29 ^A]	~	~	32
Salford	Glazebury	RU	16	19	18	19 [#]	15	17
Manchester	Manchester South	SU	24	28	23	24	22	24
Wigan	Wigan Centre	UB	24	26	23	24	25	24
Wigan	Wigan Leigh 2*	UB	25	29	25	25[26 ^A] ⁺	^	26
Annual Mean NO₂ air quality Objective			40 µg.m⁻³					

~Site closed in 2011 *Site closed in 2012, ^Site closed in 2013 #Data capture 75-90%, +Data capture less than 75%, [A] annualised data. The Mottram Moor station was incorporated into the GM network QA/QC scheme in 2013.

Table 3-6: Number of exceedences of NO₂ Hourly mean >200 µg.m⁻³ at Greater Manchester Automatic monitoring sites (including five sites which closed between 2011 and 2013).

Local Authority	Automatic Monitoring Site	Type	2009	2010	2011	2012	2013
Tameside	Tameside Two Trees School	UB	0	0	0	0	0
Tameside	Mottram Moor		Not open	Not open	Not open	Not open	Not open
Trafford	Trafford	UB	0	18	0	0	0
Bolton	Bolton College~	UB	0	0	0	~	~
Salford	Glazebury	RU	0	0	0	0	0
Manchester	Manchester South	SU	0	7	0	0	0
Wigan	Wigan Centre	UB	0	0	0	0	0
Wigan	Wigan Leigh 2*	UB	0	0	0	0	
1 Hour Mean 200µg.m⁻³			Not to be exceeded more than 18 times per year				

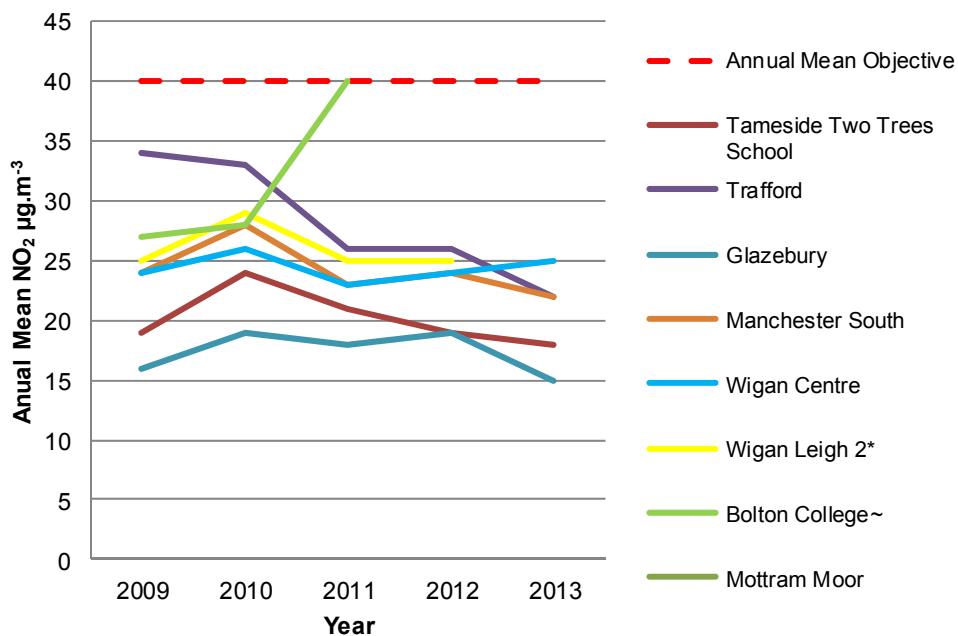
~Site closed in 2011 *Site closed in 2012

The general trend is that annual mean NO₂ concentrations have decreased between 2009 and 2013 at the majority of automatic monitoring sites outside the AQMA, with the exception of one urban background site (Wigan Centre), where concentrations increased slightly between 2012 and 2013 (Graph 3-2).

In 2013 a data capture rate of above 90% was achieved at three of the six of the automatic monitoring sites operating outside the AQMA. 2013 Annual mean NO₂ concentrations were below the annual mean NO₂ Objective at these sites (Glazebury, Manchester South, and Wigan Centre).

Greater Manchester Air Quality Monitoring

Graph 3-2 Annual Mean NO₂ µg.m⁻³ at Greater Manchester Automatic monitoring sites within the AQMA



3.1.2 Results from NO₂ Diffusion Tube Sites

There are 190 NO₂ diffusion tube monitoring locations inside, and 74 sites outside the AQMA, and 12 sites which are unclassified. Duplicate and triplicate tubes are co-located at many sites in the network, and averaged annual mean NO₂ concentrations between 2009 to 2013 from all tube monitoring results inside and outside the AQMA were analysed and the results discussed below. Table 3-7 reports the number of monitoring sites by Local Authority where averaged 2009-2013 annual mean NO₂ concentrations were above, 'just below', or 'well below' the Objective inside and outside the AQMA¹⁹.

Inside the AQMA

Averaged annual mean 2009 to 2013 monitoring results indicate that inside the AQMA, NO₂ concentrations were above the annual mean Objective at 43% of sites, just below the Objective at 11% of sites and well below the Objective at 46% of sites (Table 3-7). These results indicate that there are many areas across the city region within the AQMA where concentrations are well below annual mean Objective. The exceptions are Manchester (where monitored concentrations are above or just below at all diffusion tube sites), Bury and Tameside (which have relatively fewer sites well below the Objective).

Analysis of diffusion tube results over the same 5-year period from monitoring sites within the AQMA from kerbside, roadside, urban background and urban centre sites indicate that annual mean NO₂ concentrations have reduced at all locations (Graph 3-3, Graph 3-4 and Graph 3-5). Monitoring results show a decrease in the number of sites exceeding, and an increase in the number of sites below the annual mean NO₂ Objective.

In 2013 annual mean NO₂ concentrations were below the annual mean objective at the majority (> 90%) of roadside and urban background, and (>80%) urban centre sites. However, NO₂ concentrations were higher close to the roadside with

¹⁹ Where 'just below' is 36-39µg.m⁻³ inclusive, and 'well below' is ≤35µg.m⁻³

Greater Manchester Air Quality Monitoring

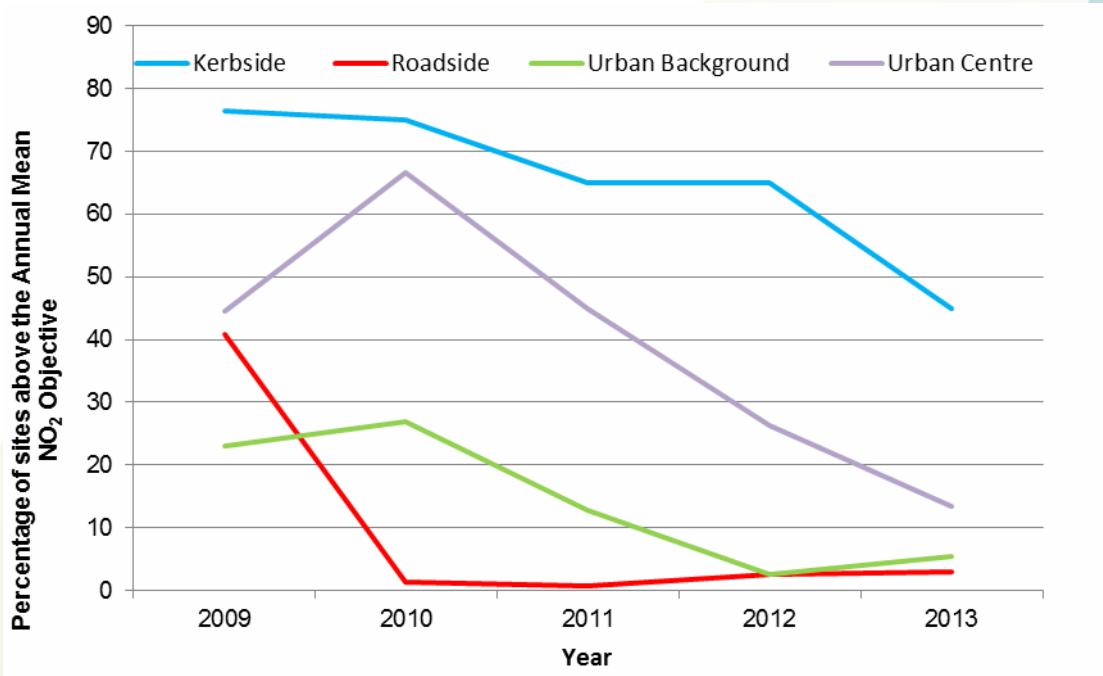
exceedances of the annual mean NO₂ Objective at just under half (45%) of kerbside sites (monitoring results provided in Appendix A).

Table 3-7 Number of NO₂ diffusion tube sites in Greater Manchester inside the AQMA with concentrations above, well below or just below the NO₂ Annual Mean Objective (based on averaged 2009-2013 concentrations).

*No monitoring sites outside the AQMA

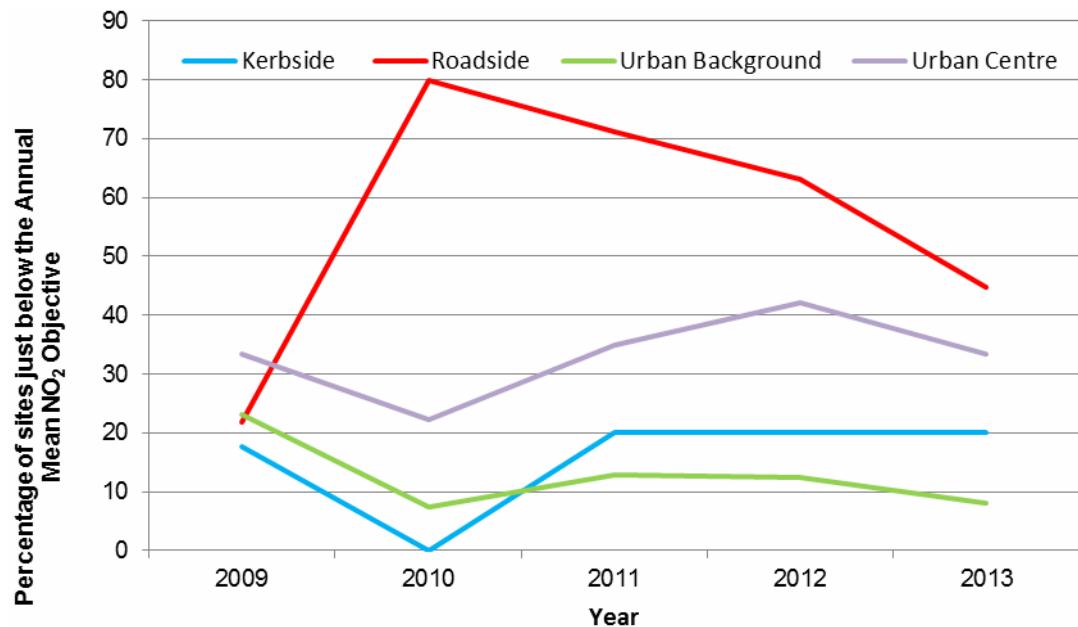
Local Authority	INSIDE AQMA			
	Above	Just Below	Well Below	TOTAL
Bolton	8	1	10	19
Bury	5	2	2	9
Manchester	25	4	9	38
Oldham	1	0	3	4
Rochdale	12	2	13	27
Salford	14	4	16	34
Stockport	8	0	8	16
Tameside	10	2	6	18
Trafford	1	1	5	7
Wigan	21	9	37	67
TOTAL	105	25	109	239

Graph 3-3 Percentage of sites Above the Annual Mean NO₂ Objective within the AQMA 2009-2013

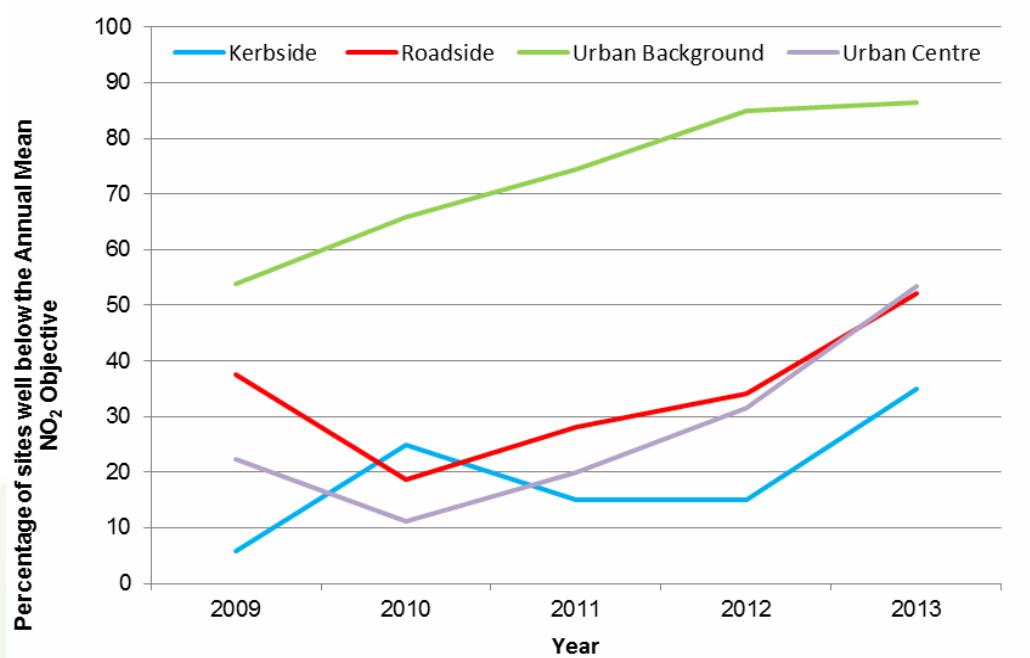


Greater Manchester Air Quality Monitoring

Graph 3-4 Percentage of sites Just Below the Annual Mean NO₂ Objective within the AQMA 2009-2013



Graph 3-5 Percentage of sites Well Below the Annual Mean NO₂ Objective within the AQMA 2009-2013



Greater Manchester Air Quality Monitoring

Outside the AQMA

Averaged annual mean NO₂ monitoring results between 2009 and 2013 indicate that outside the AQMA NO₂ concentrations were above the annual Mean Objective at 1% of sites, just below the Objective at 11% of sites and well below the Objective at 88% of sites (Table 3-8). These results indicate that in general exceedences of the annual mean NO₂ Objective outside the AQMA are unlikely, with the following exceptions: Oldham where one monitoring site is exceeding, and one site which is just below the Objective, and sites in Bolton (1), Tameside (3) and Wigan (4) which are just below the Objective. Results at these sites are discussed in more detail below.

The diffusion tube site in Oldham with annual mean NO₂ concentrations exceeding the Objective is on Kershaw Street (site ID OL7), where exceedences of the Objective are reported for two out of three years for which data are available (between 2009 and 2011). A real-time monitoring station has been located close to this monitoring site (Shaw Crompton Way), which began operating in March 2014. Results from this site will be reported in future reports. The monitoring site in Oldham with annual mean NO₂ concentrations just below the Objective is on Oldham Road, Uppermill (site ID OL8). Between 2009 and 2013 annual mean NO₂ concentrations at this site were just below the Objective for three years (2009, 2010 and 2012), and well below the Objective for two years (2011 and 2013).

In Bolton annual mean NO₂ concentrations just below the Objective were recorded at the White Horse Tavern diffusion tube site (site ID 41), where concentrations have remained just below the Objective for the last three years (2010 to 2013). Annual mean NO₂ concentrations were also just below the Objective at three diffusion tube sites in Tameside located at George Lawton Hall (site ID T28) and Stamford Road (site ID T37 and T35), where concentrations are consistently just below the objective for all years between 2009 and 2013.

Table 3-8 Number of NO₂ diffusion tube sites in Greater Manchester outside AQMA with concentrations above, well below or just below the NO₂ Annual Mean Objective (based on averaged 2009-2013 concentrations).

Local Authority	OUTSIDE AQMA			
	Above	Just Below	Well Below	TOTAL
Bolton	0	1	9	10
Bury	0	0	0	0*
Manchester	0	0	10	10
Oldham	1	1	2	4
Rochdale	0	0	6	6
Salford	0	0	2	2
Stockport	0	0	13	13
Tameside	0	3	12	15
Trafford	0	0	7	7
Wigan	0	4	22	26
TOTAL	1	9	83	93

*No monitoring sites outside the AQMA

Analysis of diffusion tube results from monitoring sites outside the AQMA (kerbside, roadside, rural, suburban, urban background and urban centre sites) indicate that between 2009 and 2013 annual mean NO₂ concentrations have reduced at all locations.

In 2013 annual mean NO₂ concentrations were below the annual mean Objective at the majority of sites (96%) outside the AQMA.

Greater Manchester Air Quality Monitoring

4 Air Quality Modelling Results

Air Quality Modelling Results

The ADMS-Urban v2.3 model was used by TfGM to predict long and short term NO₂ concentrations at sensitive receptor locations (specified points), and across Greater Manchester (using a receptor grid), for the baseline year 2010 and future year 2016. Performance of the GMEDIS model was evaluated by TfGM using statistical procedures following Defra guidance^{20,21} and model performance was found to be acceptable.

A comparison of modelled and monitored total NO₂ concentrations measured with chemiluminescent analysers found that the majority of modelled results were within 25% of monitored concentrations and model adjustment was therefore not undertaken.

4.1 Predicted NO₂ concentrations at specified points

Predicted NO₂ concentrations for 2010 and 2016 at specified points (monitoring sites and sensitive receptor locations) reported by TfGM^{12,13} are detailed in Appendix B, and the predicted change in NO₂ concentrations are also shown for comparison purposes.

Results for all specified points (a total of 1416 indicate that 2010 and 2016 annual mean NO₂ concentrations are below the annual mean NO₂ Objective at the majority of receptor locations (Table 4-1).

Some of the receptor points modelled (211) were at monitoring site locations, and results from these sites provide an indication of air quality inside and outside the AQMA. Annual mean NO₂ concentrations at these sites are predicted to be below the NO₂ air quality Objective at the majority of monitoring sites within the AQMA and at all monitoring sites outside the AQMA in 2010 and 2016 (Table 4-2).

The short term NO₂ Objective is predicted to be met at the majority of all (1416) receptor locations, with exceedences predicted at 1.8% of all receptors in 2010 and 0.5% of all receptors in 2016.

Table 4-1 Percentage of receptor locations (a total of 1416) with predicted annual mean NO₂ concentrations above and below the annual mean NO₂ Objective in 2010 and 2016.

Predicted Annual Mean NO ₂ Concentration	2010 %	2016 %
Above Objective ($\geq 40 \mu\text{g.m}^{-3}$)	8	5
Just Below Objective (36-39 $\mu\text{g.m}^{-3}$)	18	11
Well Below Objective ($\leq 35 \mu\text{g.m}^{-3}$)	74	84

Table 4-2 Percentage of monitoring sites (a total of 211) with predicted annual mean NO₂ concentrations above and below the annual mean NO₂ Objective in 2010 and 2016.

Predicted Annual Mean NO ₂ Concentration	% Inside AQMA		%Outside AQMA	
	2010	2016	2010	2016
Above Objective ($\geq 40 \mu\text{g.m}^{-3}$)	16	11	0	0
Just Below Objective (36-39 $\mu\text{g.m}^{-3}$)	36	20	2	0
Well Below Objective ($\leq 35 \mu\text{g.m}^{-3}$)	48	69	98	100

²⁰ Defra, June 2010, *Evaluating the Performance of Air Quality Models Issue 3*.

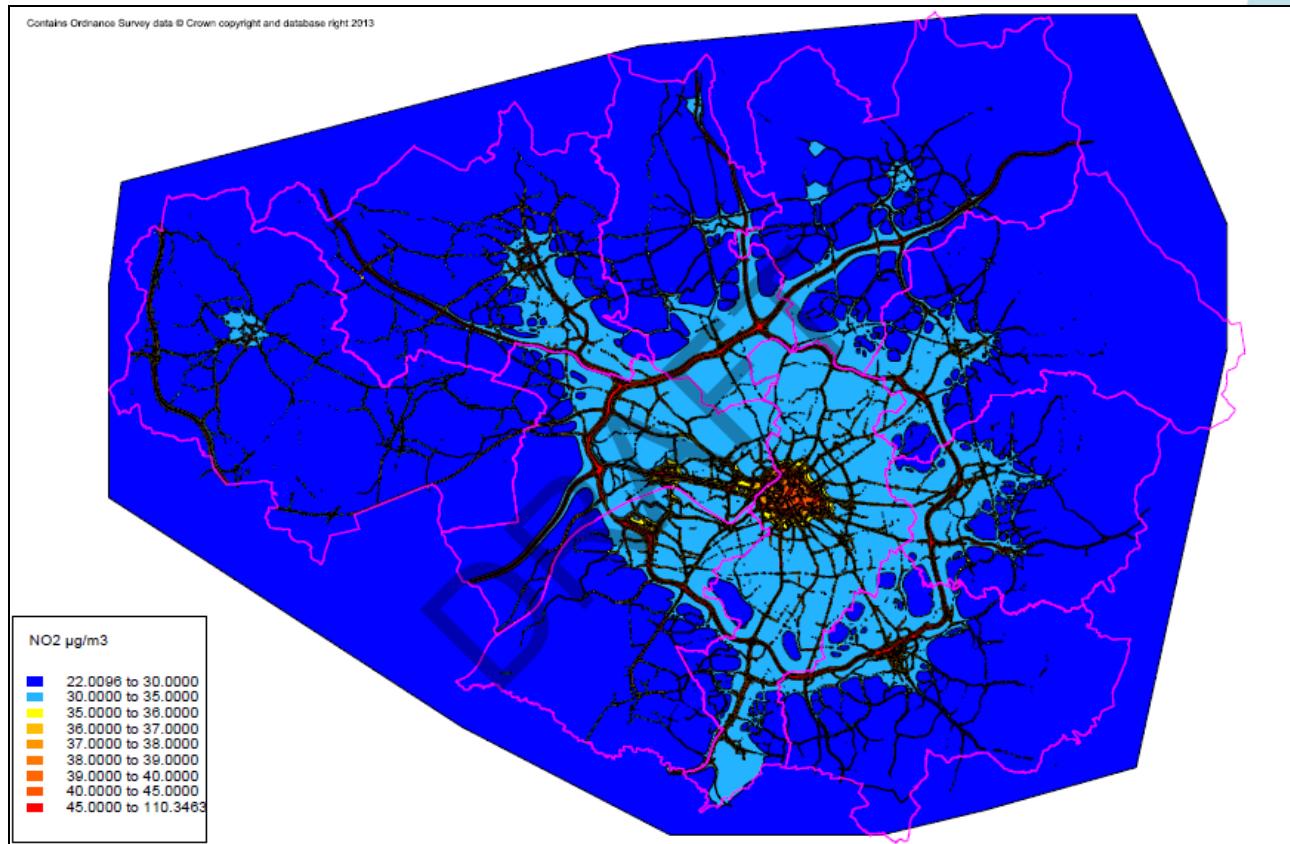
²¹ Defra, February 2009, *Local Air Quality Management Technical Guidance LAQM.TG.(09)*.

Air Quality Modelling Results

4.2 Predicted NO₂ concentrations across Greater Manchester

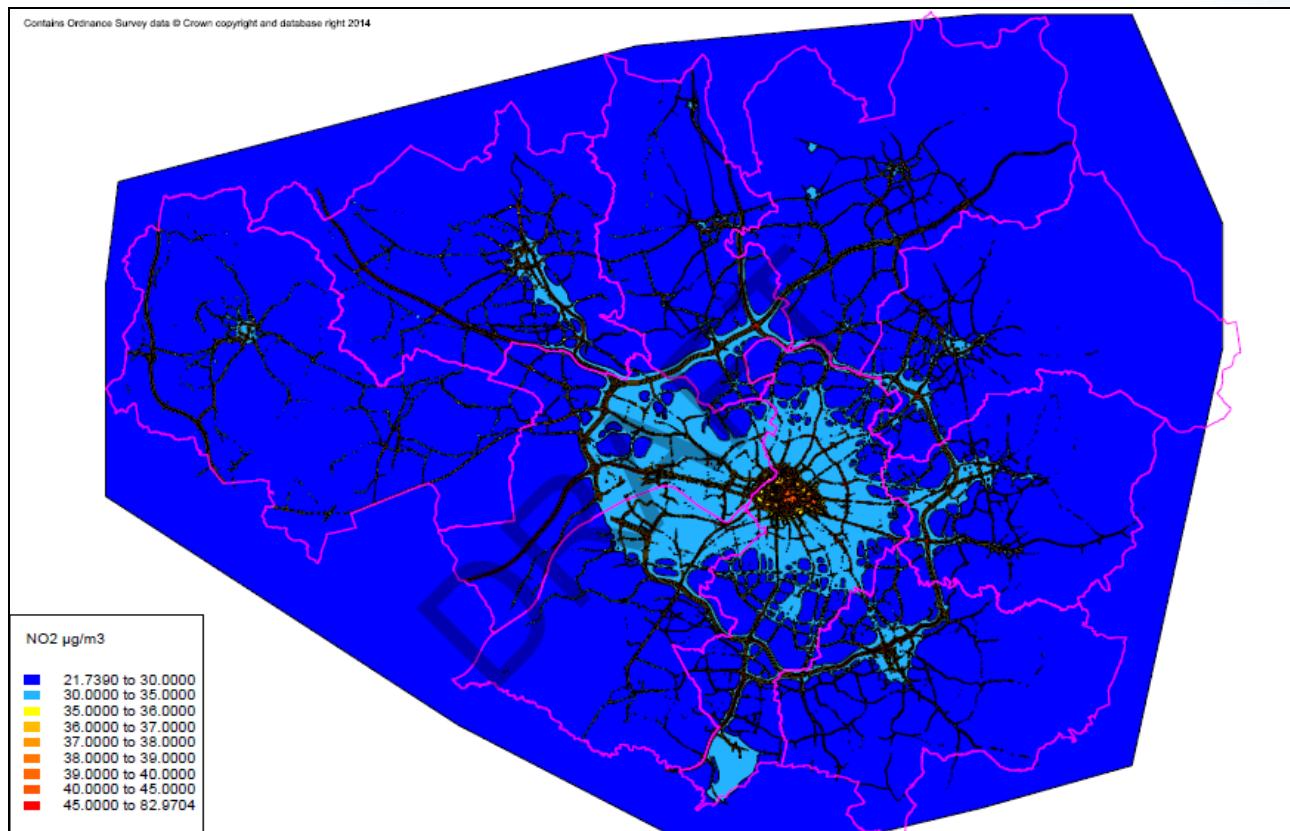
Contour plots of predicted annual mean NO₂ concentrations across Greater Manchester shown in Figure 4-1 (2010) and Figure 4-2 (2016) indicate that the highest NO₂ concentrations in 2010 and 2016 are in close proximity to motorways, major roads, town and city centres. Annual mean NO₂ concentrations across Greater Manchester are predicted to decrease between 2010 and 2016.

Figure 4-1 Contoured Modelled annual mean emissions of NO₂ across Greater Manchester 2010



Air Quality Modelling Results

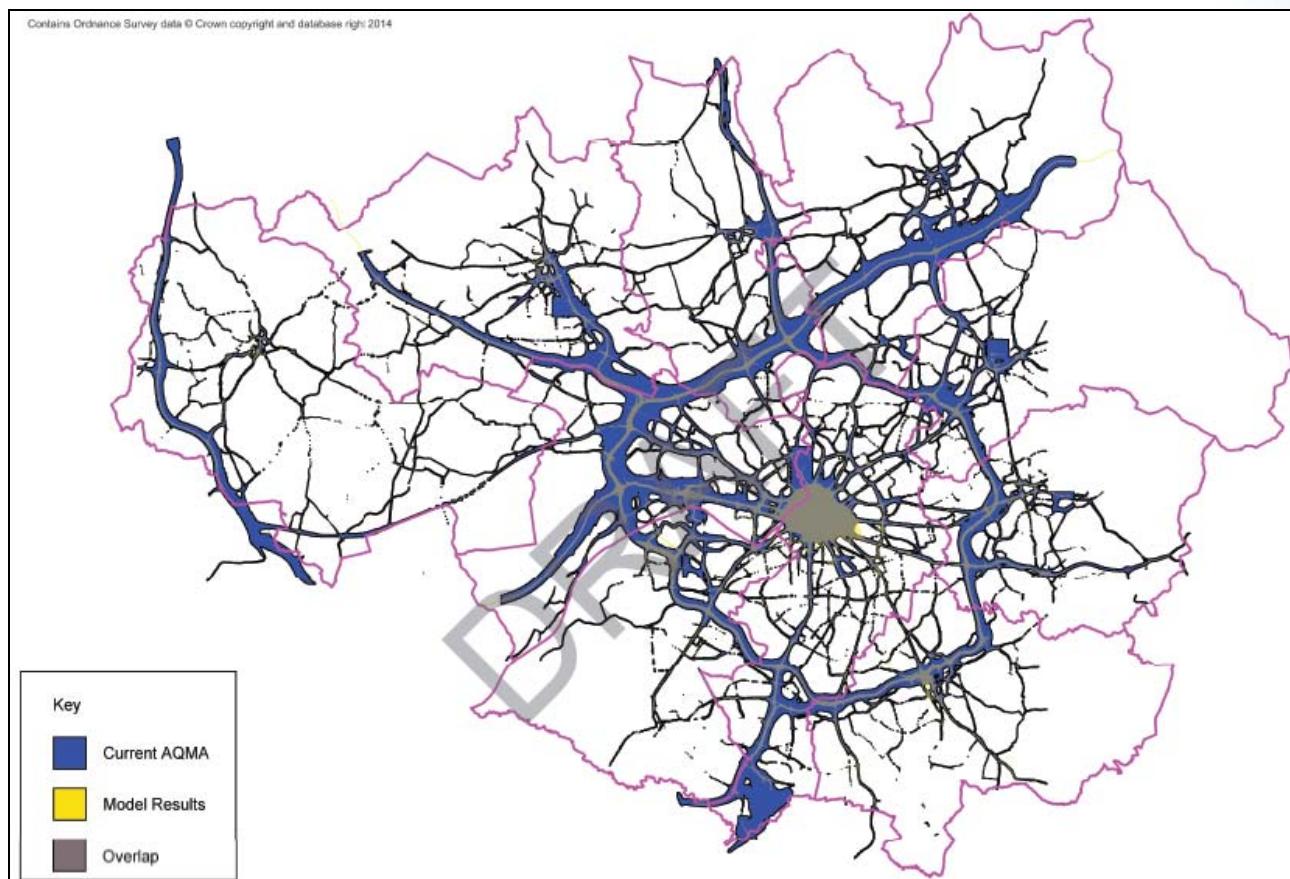
Figure 4-2 Contoured Modelled annual mean emissions of NO₂ across Greater Manchester 2016



Modelling undertaken for this detailed assessment indicates that NO₂ concentrations have decreased across Greater Manchester since the AQMA was declared in 2005. The existing AQMA boundary set at 35 µg.m⁻³ covers a much larger area than that predicted to exceed 35 µg.m⁻³ in 2016 (Figure 4-3).

Air Quality Modelling Results

Figure 4-3 Current AQMA across Greater Manchester compared with predicted 2016 35+ $\mu\text{g.m}^{-3}$ annual mean NO₂ contour.



5 Conclusions

Conclusions

A detailed assessment for NO₂ (based on detailed dispersion modelling undertaken by TfGM) was carried out on behalf of the AGMA and the Greater Manchester CA to determine the extent of exceedences of the annual average and hourly NO₂ Objectives.

The results of the predictive modelling study and the monitored concentrations at receptor point locations showed a good overall correlation, with the majority of the modelled concentrations within 25% of the monitored results.

The GMEDIS model results indicate that exceedences of the NO₂ long and short term Objectives are unlikely outside the existing AQMA boundary. The highest concentrations of NO₂ are predicted to be within the AQMA and in close proximity to motorways, major roads, town and city centres.

The percentage of modelled receptor locations where the NO₂ annual mean concentration is predicted to be breached is shown to decrease between the 2010 base year and 2016, from 8% to 5%. Similarly the proportion of locations predicted to be 'just below' the Objective is also predicted to decrease, from 18% to 11%. Consequently, the number of receptor locations where the modelling shows that concentrations are predicted to be 'well below' the Objective increases from 74% to 85%.

Modelling results also indicate that NO₂ concentrations have decreased across Greater Manchester since the AQMA was declared, with the existing AQMA boundary set at a precautionary 35 µg.m⁻³ covering a much larger area than that predicted to exceed 35 µg.m⁻³ in 2016 and the annual mean objective level of 40 µg.m⁻³.

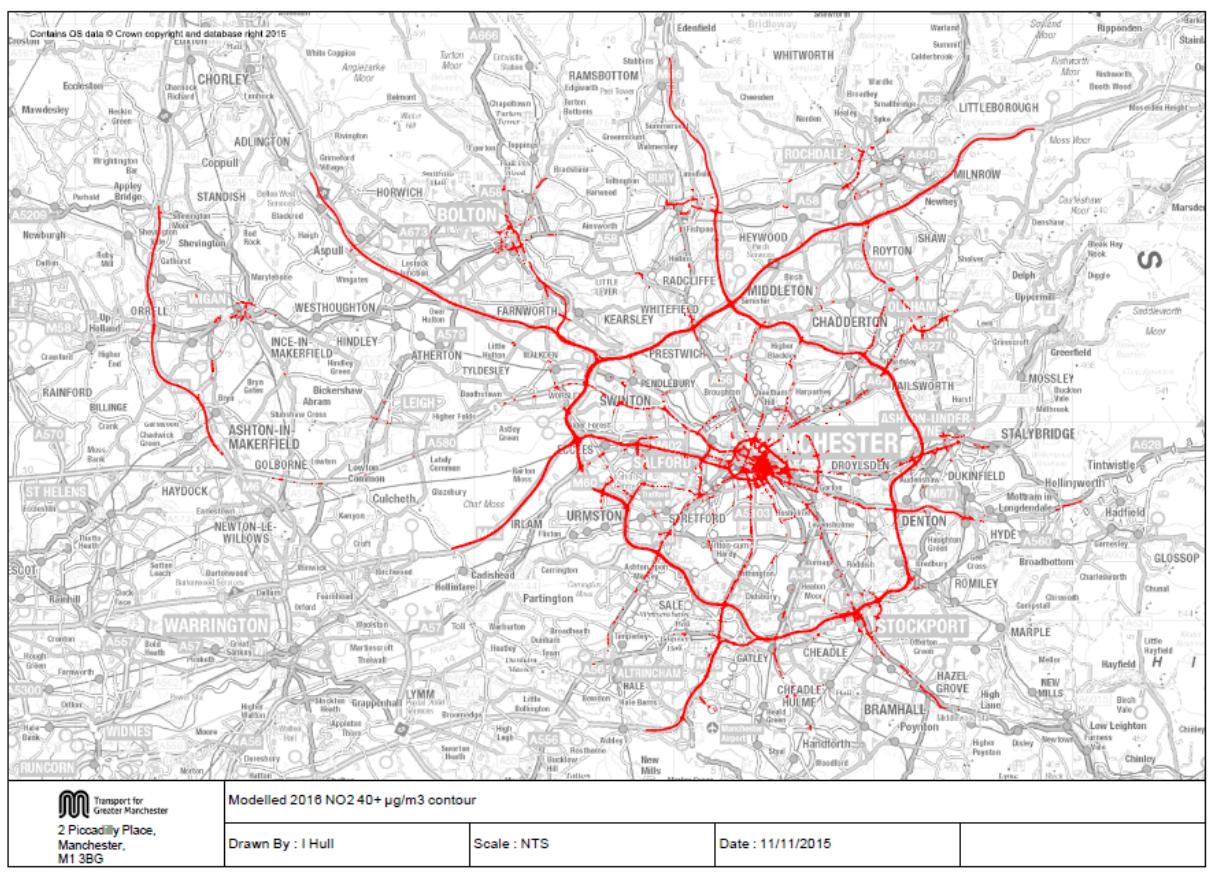
The analysis of continuous and passive diffusion tube NO₂ monitoring data over a 5-year period from 2009 to 2013, and a detailed predictive modelling study using a 2010 base year and a 2016 scenario, both indicate that the geographical extent of exceedences of the NO₂ Objective has decreased since the latest Greater Manchester AQMA was designated. The conclusion is that the boundary may be reduced back to the key road network sources according to the modelled concentrations.

Historically the Greater Manchester Authorities have declared their AQMA using the 35 µg.m⁻³ contour plot, taking a precautionary approach to determining areas where the 40 µg.m⁻³ annual mean would be exceeded. Away from the major road network many locations were included in the AQMA that have been shown to be below the NO₂ annual mean concentration.

The conclusion is that the AQMA boundary should be reduced back to the key road network sources using the modelled concentrations for 2016 as the basis for the revised contour. The decision on the boundary of the AQMA will be a matter for the GM Authorities to take. Contour plots for an NO₂ annual mean in 2016 above 40 µg.m⁻³, 37.5 µg.m⁻³, 36.4 µg.m⁻³ and 35 µg.m⁻³ are shown in Figures 5-1, 5-2, 5-3 and 5-4 respectively. The overall standard deviation of the model was 3.6 the 36.4 µg.m⁻³ contour plot shows the predicted annual mean objective concentration -1 Standard Deviation (SD).

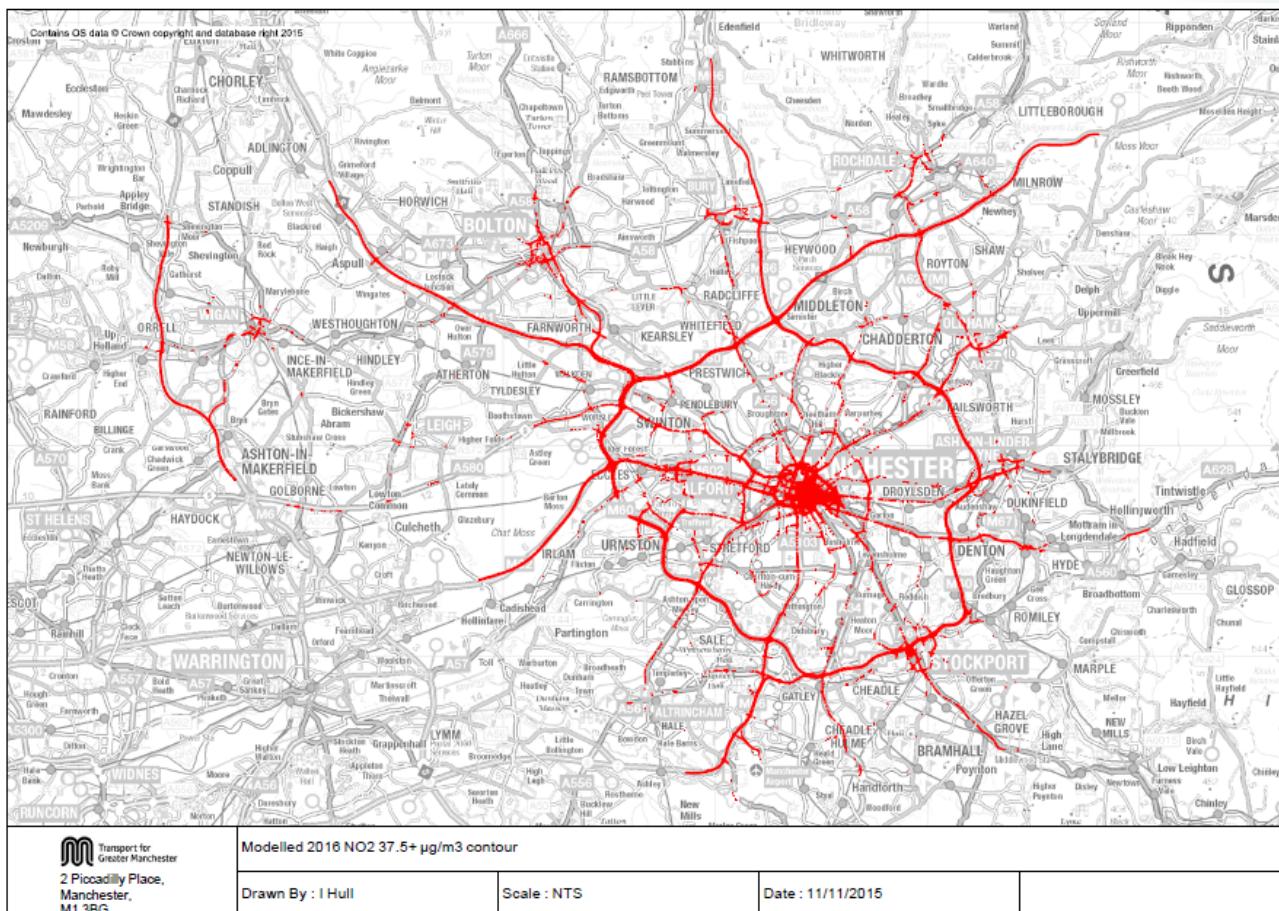
Conclusions

Figures 5-1 Modelled 2016 NO₂ 40+ µg.m⁻³ contour



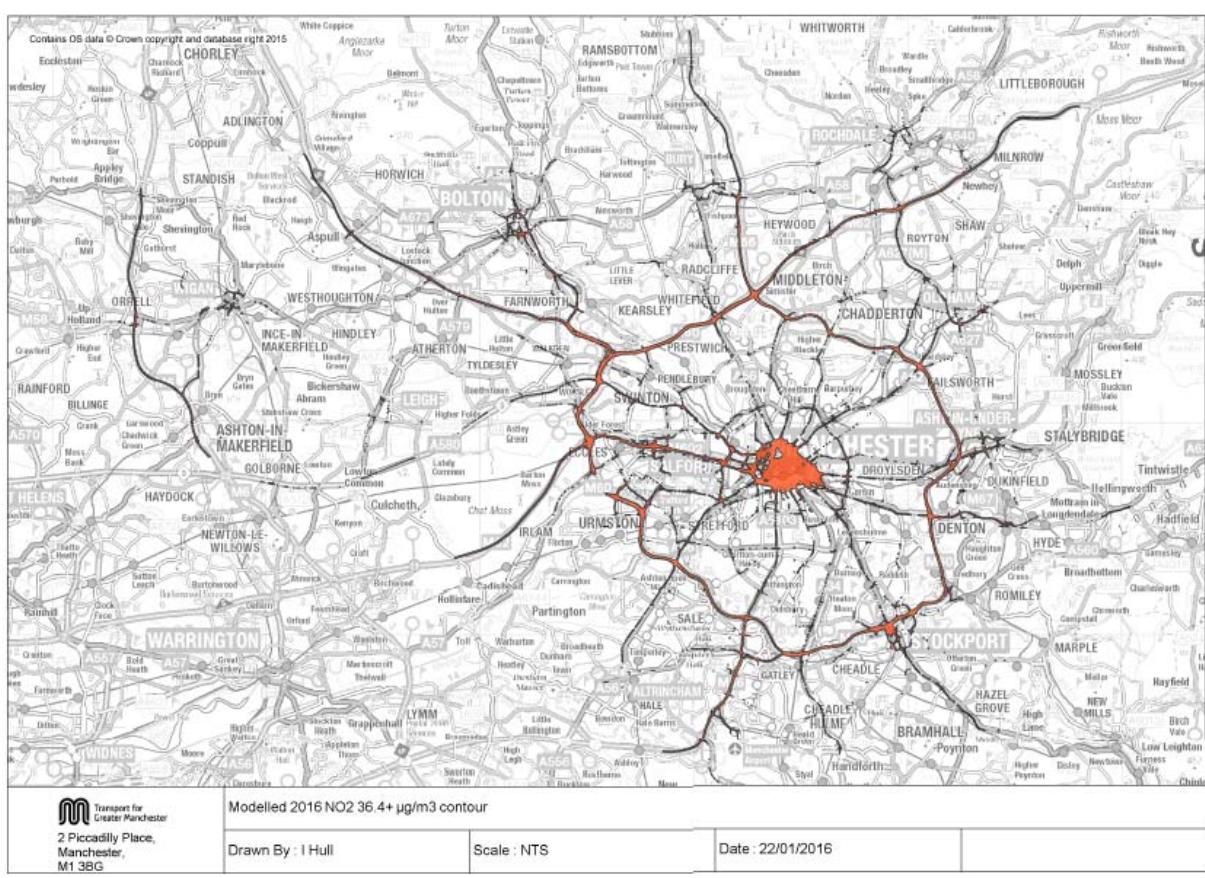
Conclusions

Figure 5-2 Modelled 2016 NO₂ 37.5+ µg.m⁻³ contour



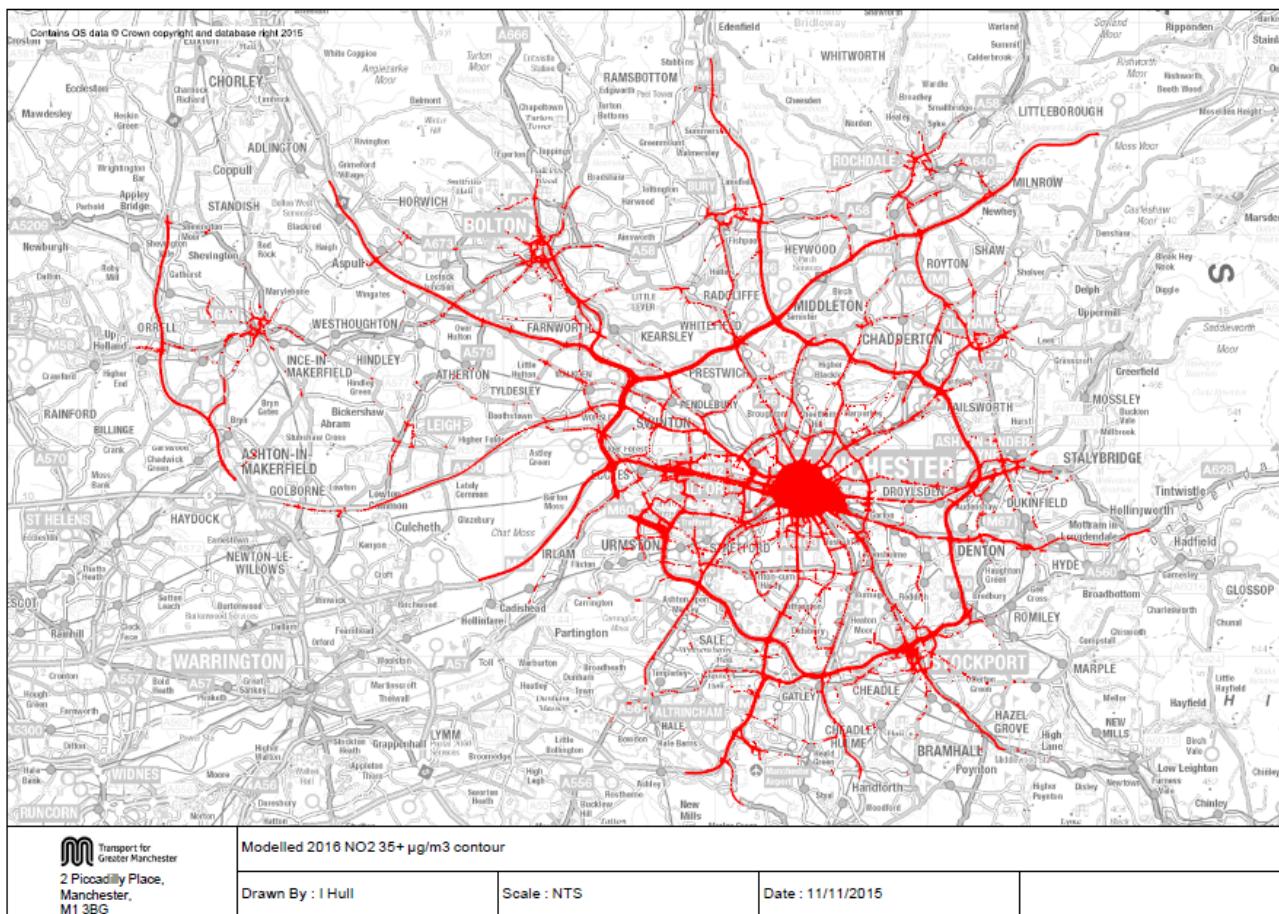
Conclusions

Figure 5-3 Modelled 2016 NO₂ 36.4 µg.m⁻³ contour



Conclusions

Figures 5-4 Modelled 2016 NO₂ 35+ µg.m⁻³ contour



Appendix A

Appendix A

Appendix A: Monitoring Data Quality Assurance and Control

Diffusion Tube Monitoring Sites

Diffusion Tube Analysis

The tubes are prepared and analysed by Staffordshire Scientific Services using the 20% triethanolamine (TEA) in water method. The laboratory method is UKAS accredited. Results from the quality control schemes published on the LAQM website give the laboratory a good precision rating.

Bias Adjustment

NO₂ diffusion tubes are affected by several factors, which may cause them to have bias (over-read), or negative bias (under-read) relative to the reference technique. To compare with the AQS objectives it's important that tubes are corrected (adjusted) by comparing with a chemiluminescent analyser reference method, for NO_x and NO₂. Collocated tubes are located at Wigan (AURN), Manchester (3 sites), Salford (2 sites) and Stockport air quality stations. The Defra Diffusion Bias Adjustment sheets are used to calculate the bias adjustment factor using these sites and the other local authority data submitted at the time.

Automatic Monitoring Sites

Automatic air quality analysers in Greater Manchester area are subject to a high level of quality assurance/ quality control. Most analysers are either operated as part of the national Automatic Urban and Rural Network (AURN) or are part of the 'Calibration Club' scheme run by Ricardo-AEA (former AEA Technology or similar schemes to provide accurate and robust data).

The procedures are equivalent to the UK Automatic Urban and Rural Network (AURN) the main features of the services being:-

Calibration Club

- data screened daily for errors and final data ratified and published to same standard as AURN sites;
- data checked twice daily for errors and faults reported to Local Site operators;
- independent audits twice a year ; and
- final data set scaled and ratified to same standard as AURN.

Casella Data Management

The Casella service is similar to the calibration club with the exception of the independent audits. On site checks do include linearity test of analysers and gas phase titration (GPT) to check converter efficiency on the NO_x instruments. Data is scaled to same standard as TG (09). TEOM data is corrected using the Volatile Correction Method.

Adjustment

Automatic monitoring sites with less than 75% data capture are adjusted to an annual mean, as set out in Box 3.2 of LAQM.TG (09). The period mean (Pm) for each site is adjusted using the ratio (Am/Pm) of the annual means (Am) at nearby sites to the period mean (Pm).

Appendix A: Annual Mean NO₂ µg.m⁻³ from Greater Manchester Diffusion Tube sites 2009-2013

Table A2: Annual Mean NO₂ µg.m⁻³ from Greater Manchester Diffusion Tube sites 2009-2013

Row	TubeRef	LA	Site id	Site Address	Site Type	2009	2010	2011	2012	2013	09-13 AVG	In AQMA	X	Y
1	Bolton48	Bolton	48	48 Ainsworth Road, Little Lever	UB	34.5	31.4	33.4	33	29.8	32.4	Y	375397	407457
2	Bolton49	Bolton	49	49 Council area office little lever	UB	24.6	25.5	24.2	21.5		24.0	N	375420	407386
3	Bolton50	Bolton	50	50 Council area office little lever	UB	25.2	25.6	24.4	23.6		24.7	N	375420	407386
4	Bolton51	Bolton	51	51 Council area office little lever	UB	24	26.3	21.5			23.9	N	375412	407365
5	Bolton52	Bolton	52	52 Front 3 Turton Rd Bromley X	Rs	42.2	40.8	43.1	43.5	36.4	41.2	Y	373251	411970
6	Bolton53	Bolton	53	53 Rear 3 Turton Rd Bromley X	UB	21.7	21.9	22.4	22	19.7	21.5	Y	373236	411968
7	Bolton54	Bolton	54	54 20 Laburnam Pk Bromley X	UB	18.8	17.7	19.4	17.1	17	18.0	N	372908	412120
8	Bolton43	Bolton	43	43 Beehive PH Chorley New Rd, Horwich	Rs	45.7	40.2	41.9	41.2	37.7	41.3	Y	365501	409887
9	Bolton44	Bolton	44	44 1007 Chorley New Rd, Horwich	UB	29.6	27.8	31.7	29.4	26.6	29.0	Y	365599	409845
10	Bolton45	Bolton	45	45 1007Chorley New Rd, Horwich	UB	30.3	29	31.7	29	26.9	29.4	Y	365599	409845
11	Bolton46	Bolton	46	46 5 Crowborough Close Horwich	UB	16.9	16.5	18.9	16.3	16	16.9	N	365694	410166
12	Bolton40	Bolton	40	40 Bolton Rd/Manchester Rd, W/H	Rs	43.1	38.1	39.2	37.4	34.1	38.4	Y	366341	406571
13	Bolton41	Bolton	41	41 White Horse Tavern Bolton Rd W/H	UB	30.5	33.1	39.2	39.6	37.5	36.0	N	366286	406561
14	Bolton3	Bolton	3	3 Quintins 329 Derby St	Rs	52	46	45.2	44.6	39.3	45.4	Y	370763	407929
15	Bolton60	Bolton	60	60 134 Buckley Lane	Ks	37.3	34.6	37.8	36.1	32.7	35.7	Y	373287	405061
16	Bolton61	Bolton	61	61 Primrose St Kearsley	Rs	42	43.3	43.7	42.4	39.6	42.2	Y	374450	405207

Appendix A

Row	TubeRef	LA	Site id	Site Address	Site Type	2009	2010	2011	2012	2013	09-13 AVG	In AQMA	X	Y
17	Bolton62	Bolton	62	62 72/74 Hr Market St	UC	44.8	46.6	45.7	32	39.4	41.7	Y	374194	405460
18	Bolton63	Bolton	63	63 2 Fern St	UB	32.4	30.1	27.6	28.7	27.9	29.3	Y	374282	406257
19	Bolton64	Bolton	64	64 Bolton Gate	Rs	33.8	31.1	36.4	33.9	29.8	33.0	Y	371965	409907
20	Bolton65	Bolton	65	65 2 Phoenix StBolton	UB	32.1	32.3	35.2	32.4	29	32.2	Y	372059	409877
21	Bolton66	Bolton	66	66 505 Blackburn Rd	Ks	46.6	48.9	49.3	45.3	39.9	46.0	Y	371442	411599
22	Bolton67	Bolton	67	67 3 the Welland	UB	27.4	27.6	26.4	24.9	27.5	26.8	N	365163	405640
23	Bolton68	Bolton	68	68 24 Winslow rd	UB	36.5	32.9	38.4	34.7	37.7	36.0	Y	367672	406910
24	Bolton4	Bolton	4	4 Manley Terrace	UB	31.9	27.8	32.6	28.2	27.4	29.6	Y	371394	411718
25	Bolton8	Bolton	8	8 Le Mans Crescent	UC	40	38	41.5			39.8	Y	371537	409091
26	Bolton10	Bolton	10	10 63 Bankfield St	UB	20.3	18.6	18.9	18.2		19.0	N	370374	408178
27	Bolton11	Bolton	11	11 Allotments Lever Park Ave Horwich	UB	19	18	24.7			20.6	N	363730	412388
28	Bolton14	Bolton	14	14 Town Hall, Market St Fwth	Rs	25	27	28.3			26.8	Y	373864	406117
29	Bolton15	Bolton	15	15 Astley Bridge Clinic, Moss Bank Way	Rs	47.4	36.7	44.9	42.4	38.1	41.9	Y	371435	411690
30	Bolton16	Bolton	16	16 Drummond St, Astley Bridge	UB	23.3	21	23.5	23.1	24.1	23.0	N	371304	411748
31	Bolton18	Bolton	18	18 Astley Bridge Bolton.	0	27.4	24.8	27.1	24.3		25.9	0	371384	411690
32	BuryBU1	Bury	BU1	BU1 Baguley Crescent	UB	41	48	40	36.6	30.3	39.2	Y	384375	404917

Appendix A

Row	TubeRef	LA	Site id	Site Address	Site Type	2009	2010	2011	2012	2013	09-13 AVG	In AQMA	X	Y
33	Bury0	Bury	0	Ramsbottom Lane	0	54				82.4	68.2	0	379115	417186
34	BuryBU3a	Bury	BU3a	BU3a Bury Roadside (AURN)	Rs	71	83	65	59.1	58.5	67.3	Y	380907	404754
35	BuryBU3b	Bury	BU3b	BU3b Bury Roadside (AURN)	Rs	71	85	63	59.7	58.7	67.5	Y	380907	404754
36	BuryBU3c	Bury	BU3c	BU3c Bury Roadside (AURN)	Rs	71	79	63	59.1	56.8	65.8	Y	380907	404754
37	BuryBU4	Bury	BU4	BU4 10 Hardmans Rd Whitefield	UB	48	52	43	39.5	39.7	44.4	Y	380974	404839
38	BuryBU5	Bury	BU5	BU5 Radcliffe New Rd. Whitefield	Ks	41	43	37	36.2	32.1	37.9	Y	380236	406427
39	BuryBU6	Bury	BU6	BU6 5 Bolton Rd Bury	Rs	44	52	39	38.9	37.5	42.3	Y	379659	410881
40	BuryBU7	Bury	BU7	BU7 Energy Show House Willow St Bury	UB	32	40	31	27.3	25.8	31.2	Y	381887	411223
41	BuryBU8	Bury	BU8	BU8 Walmersley Rd Bury	Ks	36	33	34	33.4	30.9	33.5	Y	380756	412695
42	MAN3A	MAN	3A	Burnage Community Centre	UB	30	28	23	23	20.9	25.0	N	386780	392651
43	MAN5A	MAN	5A	Styal	Su	17	19	17	15.3	13.8	16.4	N	384200	382958
44	MAN8A	MAN	8A	St Pauls School	UB	36	38	32	32.6	29.2	33.6	N	381384	387484
45	MAN12	MAN	12	Manchester Town Hall	UB	38	42	37	36.3	32.3	37.1	Y	383860	398025
46	MAN13	MAN	13	M56	Rs	57	58	55	51.1	48.9	54.0	Y	381650	387520
47	MAN9A/B	MAN	9A/B	Newton Street	Ks	60	56	58	50.7	53.4	55.6	Y	384601	398303
48	MAN14	MAN	14	Clayton Day Nursery	UB	25	27	26	25.6	22.5	25.2	N	387656	399016

Appendix A

Row	TubeRef	LA	Site id	Site Address	Site Type	2009	2010	2011	2012	2013	09-13 AVG	In AQMA	X	Y
49	MAN22	MAN	22	Cheetham Hill Road	Ks	51	47	46	43.8	40.1	45.6	Y	383948	401515
50	MAN23	MAN	23	Oldham Road	Ks	43	48	41	41.3	36.8	42.0	Y	386459	400090
51	MAN24	MAN	24	Princess Street	Ks	55	60	53	50.8	46.9	53.1	Y	383954	398060
52	MAN26A/B	MAN	26A/B	Chethams School	UC	39	40	37	34.2	33.6	36.8	Y	383971	398876
53	MAN28	MAN	28	Ashton Old Road	Ks	42	50	41	40.8	35	41.8	Y	387951	397430
54	MAN29A	MAN	29A	Oxford Street	Ks	71	72	66	65.3	62.2	67.3	Y	384117	397505
55	MAN29A	MAN	29A	Oxford Street	Ks				64.5	59.8	62.2	Y	384117	397505
56	MAN36	MAN	36	Rochdale Road	Ks	42	45	43	38.4	33.4	40.4	Y	385205	399750
57	MAN37	MAN	37	Princess Road	Rs	43	54	45	45	41.7	45.7	Y	382829	391493
58	MAN59	MAN	59	Piccadilly Gardens	UC	43	45	43	39.4	37	41.5	Y	384310	398337
59	MAN59	MAN	59	Piccadilly Gardens	UC	42	44	42	39.2	35.2	40.5	Y	384310	398337
60	MAN59	MAN	59	Piccadilly Gardens	UC	42	48	41	39.6	35.5	41.2	Y	384310	398337
61	MAN62	MAN	62	Manchester South	Su	24	28	27	25.9	23.8	25.7	N	383904	385818
62	MAN62	MAN	62	Manchester South	Su	24	28	26	25.7	23.7	25.5	N	383904	385818
63	MAN62	MAN	62	Manchester South	Su	23	28	27	25.7	22.7	25.3	N	383904	385818
64	MAN70	MAN	70	Liverpool Road	UC	48	52	45	45.9	41.2	46.4	Y	383218	397770
65	MAN71	MAN	71	Great Ancoats Street	Rs	51	50	53	49.6	44.3	49.6	Y	385161	398290

Appendix A

Row	TubeRef	LA	Site id	Site Address	Site Type	2009	2010	2011	2012	2013	09-13 AVG	In AQMA	X	Y
66	MAN72	MAN	72	Lockton Close	UB	40	45	41	39.3	35.2	40.1	Y	384761	397384
67	MAN73	MAN	73	Hyde Road	Rs	42	49	42	42.2	38.8	42.8	Y	388601	396048
68	MAN74	MAN	74	Kingsway	Rs	39	45	40	39.9	34	39.6	Y	385399	390093
69	MAN75	MAN	75	Stockport Road	Ks	52	56	52	52.7	46.7	51.9	Y	387363	394617
70	MAN76	MAN	76	Clayton Lane	UB	36	38	36	37.2	34.1	36.3	Y	387724	397967
71	MAN77	MAN	77	Hewitt Street	UC	43	49	42	41.2	39.3	42.9	Y	383602	397488
72	MAN78	MAN	78	Roston Avenue	UB	38	42	37	34.6	31	36.5	Y	386289	396828
73	MAN79	MAN	79	Victoria Terrace	UB	33	38	34	33.8	29.5	33.7	N	386875	395861
74	MAN80	MAN	80	Alma Road	Rs	40	40	35	31.4	33	35.9	N	387358	393990
75	MAN81	MAN	81	Peaceville Road	UB	31	33	28	26.6	25.5	28.8	N	386589	394083
76	MAN82	MAN	82	Manchester Oxford Road	Ks		69	70	66.7	61	66.7	Y	384233	397287
77	MAN83	MAN	83	Manchester Oxford Road	Ks		71	68	65.5	59.7	66.1	Y	384233	397287
78	MAN84	MAN	84	Manchester Oxford Road	Ks		72	66	65.8	60	66.0	Y	384233	397287
79	OldhamOL3	Oldham	OL3	OL3 Mumps roundabout, Oldham	Ks						#DIV/0!	Y	393326	405146
80	OldhamOL3	Oldham	OL3	OL9Mumps roundabout, Oldham	Ks						#DIV/0!	Y	393326	405146

Appendix A

Row	TubeRef	LA	Site id	Site Address	Site Type	2009	2010	2011	2012	2013	09-13 AVG	In AQMA	X	Y
81	OldhamOL14	Oldham	OL14	OL14Middleton Road, Chadderton	Ks	50.7	33	30.3	34.9	29.5	35.7	Y	390795	405378
82	OldhamOL7	Oldham	OL7	OL7Kershaw Street, Shaw	Rs	66.4	50	38.8			51.7	N	393766	409052
83	OldhamOL5	Oldham	OL5	OL5Terrace Street Oldham	UB	47.6	37	45			43.2	Y	393792	405166
84	OldhamOL10	Oldham	OL10	OL10Terrace, Oldham	UB	47.4	30	26.3	31.8	27.9	32.7	Y	393792	405116
85	OldhamOL17	Oldham	OL17	OL17Norfolk Street, Oldham	UB	47	31	24.8	29.7	26.2	31.7	Y	391224	403857
86	OldhamOL11	Oldham	OL11	OL11Mellor Street, Failsworth	UB	39.1	29	29.4	30	25	30.5	Y	388958	401182
87	OldhamOL12	Oldham	OL12	OL12Bluecoats School, Egerton Street, Oldham	UB	28.5	21	36	22.5	17.6	25.1	N	392902	405410
88	Oldham0	Oldham	0	OL16West End Street, Oldham	UB	40.9	31				36.0	Y	391860	405513
89	OldhamOL18	Oldham	OL18	OL18Oldham Road, Uppermill	Rs	51.1	39	32.8	39.4	32.6	39.0	N	399510	405382
90	OldhamOL19	Oldham	OL19	OL19High Street,Uppermill	Rs	46.3	32	27.6	34.3	30.2	34.1	N	399597	405525
91	Rochdale1A	Rochdale	1A	Mere Lane Rochdale	UB	22.7	29	28.6	30.4		27.7	N	389740	412501
92	Rochdale1A	Rochdale	1A	Mere Lane Rochdale	UB	24.3	31.6	28.1	32.1		29.0	N	389740	412501
93	Rochdale2A	Rochdale	2A	Trows Lane Caslteton	Rs	42.1	39.5	46.6	38.9	37.1	40.8	Y	388527	409942
94	Rochdale2A	Rochdale	2A	Trows Lane Caslteton	Rs	39.7	40.5	44.4	39.5		41.0	Y	388527	409942
95	Rochdale3A	Rochdale	3A	52 Cherrington Drive Caslteton	Rs	27.9	31.7	27.4	30.4	30.9	29.7	Y	388581	409797
96	Rochdale3A	Rochdale	3A	52 Cherrington Drive Caslteton	Rs	29.2	31.4	27.5	28.7		29.2	Y	388581	409797

Appendix A

Row	TubeRef	LA	Site id	Site Address	Site Type	2009	2010	2011	2012	2013	09-13 AVG	In AQMA	X	Y
97	Rochdale4A	Rochdale	4A	Middleton Library	UC	34	34.6	35.4	33.4	30.8	33.6	Y	387083	406258
98	Rochdale4A	Rochdale	4A	Middleton Library	UC	32	35.3	35.7	33		34.0	Y	387083	406258
99	Rochdale5A	Rochdale	5A	Mossway Middleton	Rs	31.2	28.4	28.3	26.8	25.2	28.0	Y	386447	404167
100	Rochdale5A	Rochdale	5A	Mossway Middleton	Rs	35.1	27.9	28.2	27.2		29.6	Y	386447	404167
101	Rochdale6A	Rochdale	6A	Heywood Old Rd Birch	Rs	51	47	49.5	47.9	38.2	46.7	Y	385412	408306
102	Rochdale6A	Rochdale	6A	Heywood Old Rd Birch	Rs	49.4	48.2	50.4	44.8		48.2	Y	385412	408306
103	Rochdale7A	Rochdale	7A	Edinburgh Way Rochdale	UC	34.1	40.1	39.8	36.8	32.5	36.7	Y	388628	411950
104	Rochdale7A	Rochdale	7A	Edinburgh Way Rochdale	UC	35.8	38.3	38.5	38.3		37.7	Y	388628	411950
105	Rochdale8A	Rochdale	8A	Manchester Old Rd Rochdale	Rs	43.3	50.2	49.8	47.4	40.4	46.2	Y	388914	412083
106	Rochdale8A	Rochdale	8A	Manchester Old Rd Rochdale	Rs	48.4	49.8	49.4	46.6		48.6	Y	388914	412083
107	Rochdale9A	Rochdale	9A	Manchester Rd Rochdale	Rs	47.2	53.4	57.6	46.8	40.2	49.0	Y	389055	412217
108	Rochdale9A	Rochdale	9A	Manchester Rd Rochdale	Rs	47.8	57.5	54.2	48.4		52.0	Y	389055	412217
109	Rochdale10A	Rochdale	10A	Holmes Street Rochdale	UB	21.1	21.4	21.5	21.9	21.7	21.5	Y	388789	413573
110	Rochdale10A	Rochdale	10A	Holmes Street Rochdale	UB	19.4	21.1	22	20.5		20.8	Y	388789	413573
111	Rochdale11A	Rochdale	11A	Whitworth Road Rochdale	Rs	51.4	49.1	51.7	49.1	49.3	50.1	Y	389954	413797
112	Rochdale11A	Rochdale	11A	Whitworth Road Rochdale	Rs	52.7	52.5	50.9	50		51.5	Y	389954	413797
113	Rochdale12A	Rochdale	12A	Halifax Road Wardle	Rs	44.6	42.2	46.4	44.4	42.1	43.9	Y	392061	415678

Appendix A

Row	TubeRef	LA	Site id	Site Address	Site Type	2009	2010	2011	2012	2013	09-13 AVG	In AQMA	X	Y
114	Rochdale12A	Rochdale	12A	Halifax Road Wardle	Rs	44.6	41.3	46.2	45		44.3	Y	392061	415678
115	Rochdale13A	Rochdale	13A	725 Halifax Road Wardle	UB	20.3	20.4	22.7	21.3	17.6	20.5	N	392061	415679
116	Rochdale13B	Rochdale	13B	725 Halifax Road Wardle	UB	20.3	20.4	23.1	20.9		21.2	N	392061	415679
117	Rochdale14A	Rochdale	14A	Hey Bottom Calderbrook	R	11.3	14.8	16.3	17.7	17.5	15.5	N	393666	417812
118	Rochdale14A	Rochdale	14A	Hey Bottom Calderbrook	R	11.3	14.6	16.1	20		15.5	N	393666	417812
119	Rochdale15A	Rochdale	15A	M62 Depot Milnrow	Rs	35.6	33.6	36.4	35.1	32.4	34.6	Y	392963	411889
120	Rochdale15A	Rochdale	15A	M62 Depot Milnrow	Rs	36.5	34.4	36.7	34.8		35.6	Y	392963	411889
121	Rochdale16A	Rochdale	16A	Ashfield Road Milnrow	UB	32.4	31.9	31.9	30.9	31.7	31.8	Y	392531	411700
122	Rochdale16A	Rochdale	16A	Ashfield Road Milnrow	UB	32.4	32	32.8	31.4		32.2	Y	392531	411700
123	Rochdale17A	Rochdale	17A	Kingsway Rochdale	UB	25.9	26	27.8	27.8	28.9	27.3	Y	391106	412288
124	Rochdale17A	Rochdale	17A	Kingsway Rochdale	UB	26.7	27.6	28.7	27.6		27.7	Y	391106	412288
125	SalfordSA1	Salford	SA1	SA1 Irlam Locks	UB	26.8	32.2	21.8	23.5	21.1	25.1	Y	372766	394105
126	SalfordSA2b	Salford	SA2b	SA2b Irlam Police (Princess Nursery)	UB	30.9	32.3	25.4	24.4	23	27.2	N	372141	394212
127	SalfordSA4	Salford	SA4	SA4 Crompton	Rs	33.4	35.9	29.5	28.7	26.9	30.9	Y	377452	401829
128	SalfordSA9	Salford	SA9	SA9 St Marks	UB	41.5	41	27.7	30.2	27.2	33.5	Y	374733	400935
129	SalfordSA22	Salford	SA22	SA22/23/28 Aurn Eccles	UB	38.2	41.5	31.6	33.1	28.7	34.6	Y	377925	398729
130	SalfordSA23	Salford	SA23	SA22/23/28 Aurn Eccles	UB	36.7	42.2	32.1	34.5	28.7	34.8	Y	377925	398729

Appendix A

Row	TubeRef	LA	Site id	Site Address	Site Type	2009	2010	2011	2012	2013	09-13 AVG	In AQMA	X	Y
131	SalfordSA24	Salford	SA24	SA22/23/28 Aurn Eccles	UB	36.7	43	32.1	33	28.5	34.7	Y	377925	398729
132	SalfordSA20	Salford	SA20	SA20/21/22 M60 St Marks	Rs	72	59.3	58.8	52.1	48.7	58.2	Y	374810	400856
133	SalfordSA21	Salford	SA21	SA20/21/22 M60 St Marks	Rs	70.7	59.1	57	51.2	50.3	57.7	Y	374810	400856
134	SalfordSA22	Salford	SA22	SA20/21/22 M60 St Marks	Rs	69.7	57.6	55.7	49.5	51.3	56.8	Y	374810	400856
135	SalfordSA14	Salford	SA14	SA14 Broughton Lib	Ks	42.8	40.5	39.3	33.3	31.1	37.4	Y	382851	400987
136	SalfordSA16	Salford	SA16	SA16 Wharton School	UB	29.3	32.1		27.1	24.4	28.2	Y	371154	404456
137	SalfordSA13	Salford	SA13	SA13 Buckland Road	UB	31.2	32.4	27.4	27.5	23.5	28.4	N	379613	399783
138	SalfordSA25	Salford	SA25	SA25 16 Wyn Gdns	Rs	37.2	36.2	28.6	32	28.7	32.5	Y	381297	398032
139	SalfordSA26	Salford	SA26	SA26 A580 Elect sub stn	Rs	46.3	49.6	37.8	40.9	34.9	41.9	Y	380719	399599
140	SalfordSA27	Salford	SA27	SA27 Trinity Way	Rs	45.5	45.7	36.7	36.5	36.5	40.2	Y	383076	398738
141	SalfordSA28	Salford	SA28	SA28 Harroby, Swinton	Rs	42.3	41.2	36.9	35.2	33.1	37.7	Y	377289	401009
142	SalfordSA31	Salford	SA31	SA31 Walkden Road	Rs	39.7	39.5	32.2	32.3	30.6	34.9	Y	374025	401905
143	SalfordSA32	Salford	SA32	SA32/40/41 Edenfield Drive	Rs	54.8	47.4	44.8	44.3	36	45.5	Y	374712	399829
144	SalfordSA40	Salford	SA40	SA32/40/41 Edenfield Drive	Rs	51.6	51.9	45.6	40.6		47.4	Y	374712	399829
145	SalfordSA41	Salford	SA41	SA32/40/41 Edenfield Drive	Rs	53.2	48.8	43.9	44.4		47.6	Y	374712	399829
146	SalfordSA33	Salford	SA33	SA33 Arnfield Drive, Boothstown	Rs	37.6	36.9	33.4	32.3	31.3	34.3	Y	372597	400728
147	SalfordSA34	Salford	SA34	SA34 673 Liverpool Road	Rs	62.2	63.6	52.1	50.5	47.1	55.1	Y	375367	397799

Appendix A

Row	TubeRef	LA	Site id	Site Address	Site Type	2009	2010	2011	2012	2013	09-13 AVG	In AQMA	X	Y
148	SalfordSA35	Salford	SA35	SA35 50 Trevor Road	Rs	41.4	42.8	36.9	33.6	29.8	36.9	Y	376043	399295
149	SalfordSA37	Salford	SA37	SA37 61 Maurice Drive	Rs	35.7	36.2	32.3	31.6	27.9	32.7	Y	380800	399633
150	SalfordSA38	Salford	SA38	SA38 Clifton Primary School	Rs	40.2	41.2	32	34.9	29.3	35.5	Y	377788	403066
151	SalfordSA39	Salford	SA39	SA39 Trinity Way /Chapel Street	Rs	53.4	47.6	40.9	41.2	37.5	44.1	Y	383040	398563
152	SalfordSA42	Salford	SA42	SA42 44 Edenfield	Rs	52.9	51.1	46.7	42.4	44.2	47.5	Y	374695	399853
153	SalfordSA17	Salford	SA17	SA17 Langley Road	Ks	42.9	42.9	38	36.3	33.3	38.7	Y	380740	400868
154	SalfordSA44	Salford	SA44	SA44 Pembroke (No2)	Rs	53.1	48.5	43.5	40.5	36.2	44.4	Y	380412.05	398439.43
155	SalfordSA45	Salford	SA45	SA45 Rail No1 (strawberry)	UB		34.4	29.7	24.4		29.5	Y	381542	399378
156	SalfordSA46	Salford	SA46	SA46 Rail No 2 Longfield Crt	UB		32.5	28	29.3		29.9	Y	376451	402318
157	StockportSK 1	Stockport	SK 1	Whitehill Firestation	UB	22	26	25	23	20.3	23.3	Y	389077	392012
158	StockportSK 2	Stockport	SK 2	HealdGreen Health Cen.	UB	24	29	25	25.3	24	25.5	N	384889	385846
159	StockportSK 3	Stockport	SK 3	Denby Lane	UB	28	31	30	28.9	27.6	29.1	Y	388558	391852
160	StockportSK 4	Stockport	SK 4	Compstall Library	Ru	14	18	15.3	16	15.7	15.8	N	396468	390801
161	StockportSK 5	Stockport	SK 5	Lyme Farm	Ru	9	11	9.9	9.4	10.1	9.9	N	396873	382687
162	StockportSK 6	Stockport	SK 6	Cheadle Library	UB	19	23	21.5	26.7	19.4	21.9	N	385953	388534
163	StockportSK 7	Stockport	SK 7	Civiccentre Hazel Grove	Rs	46	52	47.6	49.5	51	49.2	Y	392062	386970

Appendix A

Row	TubeRef	LA	Site id	Site Address	Site Type	2009	2010	2011	2012	2013	09-13 AVG	In AQMA	X	Y
164	StockportSk 8	Stockport	Sk 8	Marshalls Yard Hazel Grove	UB	24	27	29.8	28.6	26.3	27.1	Y	392017	387043
165	StockportSk 9	Stockport	Sk 9	Alderley Close Hazel Grove	UB	15	18	15.1	16	13.9	15.6	N	392743	385680
166	StockportSK10	Stockport	SK10	Deneside Cres. Hazel Grove	UB	17	20	18.4	17.5	16.4	17.9	N	392781	387272
167	StockportSK11	Stockport	SK11	Norwood Road	Rs	40	45	47.4	46.5	41.5	44.1	Y	391082	387938
168	StockportSK12	Stockport	SK12	A34 Kingsway	Rs	63	66	56.1	60.7	49.7	59.1	Y	385028	388278
169	StockportSK13	Stockport	SK13	Prospect Vale	UB	18	22	20.6	20.3	18.2	19.8	N	394679	386365
170	StockportSK14	Stockport	SK14	Upton Ave.	UB	19	20	19.1	20.5	19.5	19.6	N	387362	385910
171	StockportSK15	Stockport	SK15	Bramhall Lane	Rs	40	42	41	42.6	35.9	40.3	Y	389887	388958
172	StockportSK16	Stockport	SK16	Stockport Rd. Bredbury	Rs	26	34	27.8	30.6	27	29.1	Y	391563	391223
173	StockportSK17	Stockport	SK17	Yew Street	UB	29	34	29.8	30.8	27.7	30.3	Y	388471	390093
174	StockportSK18	Stockport	SK18	Debenhams	UC	48	46	47	50.2	42.8	46.8	Y	389260	390407
175	StockportSK19	Stockport	SK19	Gorton Road	Rs	47	47	46.5	46.2	43.7	46.1	Y	389481	393470
176	StockportSK20	Stockport	SK20	Kennilworth Road	UB	42	53	42.3	45.2	42.8	45.1	Y	386481	389530
177	StockportSK21	Stockport	SK21	Carmichael Street	UB	23	30	28.3	29.5	24.7	27.1	N	388599	389412
178	StockportSK22	Stockport	SK22	A6 Hazel Grove	Rs	26	31	26.6	30	30	28.7	Y	391480	387633
179	StockportSK22	Stockport	SK22	A6 Hazel Grove	Rs	26	31	26.6	29.3	29.7	28.5	Y	391480	387633
180	StockportSK22	Stockport	SK22	A6 Hazel Grove	Rs	25	31	27.3	29.1	28.9	28.3	Y	391480	387633

Appendix A

Row	TubeRef	LA	Site id	Site Address	Site Type	2009	2010	2011	2012	2013	09-13 AVG	In AQMA	X	Y
181	StockportSK25	Stockport	SK25	Central Marple	Rs	29	32	30.6	31.6	29.2	30.5	N	395767	388653
182	StockportSK26	Stockport	SK26	Midland Road	UB	17	21	21.2	19.5	16.7	19.1	N	389405	387339
183	StockportSK27	Stockport	SK27	Pinewood Close	UB	18	24	20.5	21.2	18.1	20.4	N	387099	391385
184	StockportSK28	Stockport	SK28	Finney Lane	Rs	40	49	42.2	44.8	41.1	43.4	Y	385702	386226
185	StockportSK29	Stockport	SK29	Russell Street	UB	20	24	20.9	22.2	19.8	21.4	N	390085	388547
186	TamesideT 1	Tameside	T 1	King Street Dukinfield	Rs	33.9	31.9	35.7	32.9	26.5	32.2	Yes	394050	397190
187	TamesideT 2	Tameside	T 2	Hyde Town Hall Hyde	UB	28			30.1	30.4	29.5	No	394770	394930
188	TamesideT 3	Tameside	T 3	Thompson Road Denton	UB	29.6	29.2	30.5	29.4	26.6	29.1	Yes	391000	395130
189	TamesideT SPEC	Tameside	T SPEC	Penny Meadow Ashton	Rs	52.5	44.9	52.9	36.3	32.5	43.8	Yes	394200	399260
190	TamesideT 5	Tameside	T 5	Green Lane Hollingworth	UB	15.9	17.5	17	17.6	16.1	16.8	No	400510	396520
191	TamesideT 9	Tameside	T 9	Two Trees School Denton	UB	19	19	19.8	19.6	18.9	19.3	No	393440	394330
192	TamesideT 10	Tameside	T 10	Guide Lane Audenshaw	Rs	45.2	42	44.3	42.6	38.4	42.5	Yes	392520	396760
193	TamesideT 11	Tameside	T 11	Market Street Hollingworth	Rs	73.3	59.7	71.8	58.9	68	66.3	Yes	400410	396060
194	TamesideT 13	Tameside	T 13	Manchester Road Ashton	Rs	44.4	40.7	44.8	43.2	39.3	42.5	Yes	392590	398430
195	TamesideT 14	Tameside	T 14	Park Parade Ashton	Rs	38.9	34.6	40.9	36.7	35.1	37.2	Yes	393710	398790
196	TamesideT 15	Tameside	T 15	Stamford Street Stalybridge	Rs	29.8	29.4	31	30.1	28.5	29.8	Yes	395410	398730

Appendix A

Row	TubeRef	LA	Site id	Site Address	Site Type	2009	2010	2011	2012	2013	09-13 AVG	In AQMA	X	Y
197	TamesideT 16	Tameside	T 16	Manchester Road Audenshaw	Rs	38.4	38.3	41.5	45.5	40.1	40.8	Yes	391470	397930
198	TamesideT 17	Tameside	T 17	Manchester Road Droylsden	Rs	35.2	35.2	36.1	31.4		34.5	Yes	389400	398220
199	TamesideT 18	Tameside	T 18	Manchester Road Denton	Rs				49	44.6	46.8	Yes	392120	395510
200	TamesideT 19	Tameside	T 19	Manchester Road Crown Point	Rs	41.2	41.3	43.6	37.6	38.2	40.4	Yes	392490	395500
201	TamesideT 20	Tameside	T 20	B&Q Hyde	Rs	42.6	39.1	43	40.3	37.8	40.6	Yes	394540	395110
202	TamesideT 21	Tameside	T 21	Woolley Lane Hollingworth	Rs	50.6	48.4	53.4	46.9	50.4	49.9	Yes	400400	395980
203	TamesideT 22	Tameside	T 22	Dean Street Ashton	UB	25.3	24.4	25.2	25.8	21.7	24.5	No	393250	399160
204	TamesideT 23	Tameside	T 23	Cavendish Mill Ashton	UB	24		24.1	26	22.5	24.2	No	393620	398590
205	TamesideT 24	Tameside	T 24	Manchester Road Denton (Golf Course)	Rs	38.6	40.1	38.8	38.5	33.8	38.0	Yes	390490	395630
206	TamesideT 25	Tameside	T 25	Oldham Road Ashton	Rs	30.3	30.3	31.5	29.6	27.2	29.8	Yes	393060	401060
207	TamesideT 26	Tameside	T 26	Lees Road Ashton	Rs	25.8	23.9	28.1	27.4	23.1	25.7	No	394940	395630
208	TamesideT 27	Tameside	T 27	Acres Lane Stalybridge	Rs	31.6	38.9		30.5	29	32.5	Yes	396520	398310
209	TamesideT 28	Tameside	T 28	George Lawton Hall Mossley	Rs	41.9	32		39.6	35.1	37.2	No	397040	402440
210	TamesideT 29	Tameside	T 29	Keane Street Ashton	Su	28.8	27	29	24	27.5	27.3	No	393370	399493
211	TamesideT 30	Tameside	T 30	Oldham Road Ashton	Rs	42	41.3	45	32.1	37.4	39.6	Yes	393380	399810
212	TamesideT 31	Tameside	T 31	Waterton Lane Mossley	Su	23.6	21.2	22.3	22.2	19.4	21.7	No	396900	402450

Appendix A

Row	TubeRef	LA	Site id	Site Address	Site Type	2009	2010	2011	2012	2013	09-13 AVG	In AQMA	X	Y
213	TamesideT 32	Tameside	T 32	Arundel Street Mossley	Rs	28.6	26.9	29.1	27.4	25	27.4	No	396982	402437
214	TamesideT 33	Tameside	T 33	Lees Road Mossley	Rs	26.1	25.5	28.8	28.1	22.9	26.3	No	397010	402560
215	TamesideT 34	Tameside	T 34	Stockport Road Mossley	Rs	34.1	33.4	34.2	34.6	31.1	33.5	No	397090	402620
216	TamesideT 35	Tameside	T 35	Stamford Road Mossley	Rs	42.7	38.4	39.7	41	38	40.0	No	397080	402540
217	TamesideT 36	Tameside	T 36	Argyle Street Mossley	Su	25.9	21.5	24.3	25.3	24.4	24.3	No	397060	402390
218	TamesideT 37	Tameside	T 37	Stamford Street Mossley	Rs	41.4	37.4	40.7	39.7	35.3	38.9	No	397720	402050
219	Trafford3	Trafford	3	3 Dunham Sewage Works	Ru	16.6	22.7	17.2	20.4	17.7	18.9	N	372680	387541
220	Trafford4	Trafford	4	4 Altrincham General Hospital	UC	27.1	32	24.4	27.3	26	27.4	N	376650	387831
221	Trafford5	Trafford	5	5 Sale Leisure Centre	UC	27.9	32.4	23.9	27.8	29.1	28.2	N	379119	392033
222	Trafford9	Trafford	9	9 Trafford, Town Hall 12 (m)	UB	26.1	30.1	22.8	33.8	26.6	27.9	N	380904	395817
223	Trafford13	Trafford	13	13 A56 White City	UC	34.9	31	28.6	34.8	31.6	32.2	Y	381221	396441
224	Trafford6	Trafford	6	6 A56 Junction, Edge Lane	UC	37.2	46.1	30.8	35.6	31.8	36.3	Y	379699	394452
225	Trafford7	Trafford	7	7 A56 Junction, M60	UC	39	35.4	29.3	35.1	32.7	34.3	Y	379083	393283
226	Trafford8	Trafford	8	8 M60 Junction Parkway	UC	36.3	45.4	28.8	33.1	27.8	34.3	Y	377447	395749
227	Trafford9	Trafford	9	9 Stockport Road, Timperley	UB	35.4	39.3	19.4	21.3	21.3	27.3	Y	379073	389099
228	Trafford10	Trafford	10	10 A56 Marsland Road	Rs	25.7	40.6	25.2	31.3	28.2	30.2	Y	378004	391466
229	Trafford19	Trafford	19	19w Moss Park School (AQMA)	UB	24.7	45.9	20.4	22.6	17.2	26.2	N	378783	394728

Appendix A

Row	TubeRef	LA	Site id	Site Address	Site Type	2009	2010	2011	2012	2013	09-13 AVG	In AQMA	X	Y
230	Trafford20	Trafford	20	20w A56 Chester Road AQMA	Rs	39.2	42.6	32.2	36.2	33.9	36.8	Y	379418	394009
231	Trafford21	Trafford	21	21w Cleansing Depot	Rs	29.3	37.9	24.5	27.9	25.6	29.0	N	379619	396371
232	Trafford22	Trafford	22	22w A56 corner of De Quincey Road	Ks	37.9	30.5	32.8	40.4	38.4	36.0	Y	377061	390086
233	Trafford23	Trafford	23	Stroma Gardens	Rs				45.6	38.9	42.3	Y	376438	396383
234	Trafford24	Trafford	24	Tithebarn Road	Ks				30.4	28.7	29.6	N	379263	385806
235	Wigan 1	Wigan	1	Ashwood Avenue 2, Ashton (M6)	RS	42.6	43.4	44.2	42.3	32.8	41.1	Y	357045	398774
236	Wigan 2	Wigan	2	Shevington Moor, Standish	RS	29.6	33.7	34.4	30.2	28.2	31.2	Y	354199	410631
237	Wigan 3	Wigan	3	Linden Court, Orrell	RS	30.4	37.2	37.1	34.4	30.9	34.0	Y	353271	404657
238	Wigan 55	Wigan	55	Orrell Road 3, Orrell (M6)	RS	31.2	39	34.4	35	28	33.5	Y	354114	404803
239	Wigan 5	Wigan	5	Parkside Crescent, Orrell (M6)	RS	33.4	39	53.9			42.1	Y	353827	404570
240	Wigan 6	Wigan	6	Twist Lane, Leigh	RS	33.4	39	37.1	35.7	31.6	35.4	Y	364956	400208
241	Wigan 7	Wigan	7	Old Hall Drive 2, Ashton (M6)	RS	37.2	43.4	42.4	39.8	35.5	39.7	Y	357198	398588
242	Wigan 8	Wigan	8	Queens Arms Hotel, Astley (A580 Juction)	RS	35.7	45.2	42.4	42.5	33.9	39.9	Y	371452	400960
243	Wigan 9	Wigan	9	Warrington Road, Hawley, Wigan	RS	38.8	47.8	45	45.2	40.2	43.4	Y	356857	402846
244	Wigan 11	Wigan	11	Dobson Parkway, Ince	RS	27.4	31	47.7			35.4	N	360233	405170
245	Wigan 12	Wigan	12	Leigh Road, Hindley Green	RS	28.1	36.3	33.6	33.7	32.3	32.8	N	364029	402961

Appendix A

Row	TubeRef	LA	Site id	Site Address	Site Type	2009	2010	2011	2012	2013	09-13 AVG	In AQMA	X	Y
246	Wigan 13	Wigan	13	Atherton Road, Hindley+C89	RS	33.4	41.6	38.9	37.4	36.4	37.5	N	361702	404113
247	Wigan 14	Wigan	14	Wigan Road, Atherton	RS	35	38.1	36.2	35.7	32.3	35.5	Y	366880	403254
248	Wigan 15	Wigan	15	Atherton Road, Hindley	RS	35.7	39	37.1	36	41.1	37.8	N	362290	403878
249	Wigan 0	Wigan	0	Manchester Road, Tyldesley 3	RS	42.6	43.4	44.2	42.4	37.5	42.0	Y	369528	402023
250	Wigan 0	Wigan	0	East Lancs. Road, Astley 1(A580)	RS	38	47	73.3			52.8	Y	370622	400574
251	Wigan 18	Wigan	18	Lower Green Lane, Astley	RU	16	30.1	38.9			28.3	N	370173	398600
252	Wigan 20	Wigan	20	Fletcher Street , Atherton	RS	26.6	34.6	31.8	30.2	27.2	30.1	Y	367357	403206
253	Wigan 21	Wigan	21	Car Street, Platt Bridge	KS	31.2	33.7	49.4			38.1	Y	360438	402556
254	Wigan 22	Wigan	22	Fire Station, Newtown	RS	31.9	34.6	32.7	33.3	28.5	32.2	Y	356973	405147
255	Wigan 0	Wigan	0	Atherton Road, Hindley	RS	37.2	43.4	36.2	35.8	33.3	37.2	Y	361834	404089
256	Wigan 24	Wigan	24	Wigan Town Hall 2, Wigan	RS	38.8	39.9	35.3	33.8	28.2	35.2	Y	358342	405539
257	Wigan 25	Wigan	25	Walthew Lane, Platt Bridge	RS	33.4	38.1	37.1	34.6	32	35.0	Y	360291	402963
258	Wigan 26	Wigan	26	Bolton Road Atherton	RS		34.6	32.7	34.4	32.8	33.6	Y	368201	403595
259	Wigan 27	Wigan	27	Ladies Lane, Hindley	RS	27.4	30.1	29.1	28.4	24.9	28.0	Y	361916	404822
260	Wigan 28	Wigan	28	Turner Street, Leigh	RS	38.8	40.8	42.4	41.9	35.8	39.9	Y	366423	399893
261	Wigan 29	Wigan	29	Walmesley Street, Wigan	RS	38	42.5	39.7	39.4	36.9	39.3	Y	358741	405336
262	Wigan 30	Wigan	30	Smiths Lane, Hindley Green	RS	27.4	31	28.3	28.5	26.6	28.4	N	363828	402032

Appendix A

Row	TubeRef	LA	Site id	Site Address	Site Type	2009	2010	2011	2012	2013	09-13 AVG	In AQMA	X	Y
263	Wigan 31	Wigan	31	Manchester Road, Tyldesley 2	RS	35	40.8	37.1	36.3		37.3	Y	370440	401959
264	Wigan 32	Wigan	32	The Oval 2, Shevington (M6)	RS	33.4	38.1	34.4	33.5		34.9	Y	353832	408190
265	Wigan 33	Wigan	33	Rose Court, Ince	RS	47.1	45.2	42.4	43.4	40.2	43.7	Y	359726	405534
266	Wigan 34	Wigan	34	Rydal Street, Leigh	RS	36.5	40.8	38.9	37.2	35.9	37.9	Y	365381	399990
267	Wigan 35	Wigan	35	Woodfield Crescent, Ashton (M6)	RS	41	43.4	47.7	42.8	36.1	42.2	Y	357130	398668
268	Wigan 36	Wigan	36	Smallshaw Crescent, Ashton	RS	30.4	35.4				32.9	Y	357368	398952
269	Wigan 37	Wigan	37	Satinwood Close 2, Ashton (M6)	UC	35.7	41.6	40.6	38.3	32.9	37.8	Y	356913	399045
270	Wigan 38	Wigan	38	Ashwood Avenue 3, Ashton (M6)	RS	41.8	44.3	58.3			48.1	Y	357045	398755
271	Wigan 39	Wigan	39	Ashwood Avenue 1, Ashton (M6)	RS	38	46.1	47.7	44.3	40.3	43.3	Y	357053	398794
272	Wigan 40	Wigan	40	Whalley 2, Wigan	RS	30.4	35.4	33.6	33.6	29.6	32.5	Y	359776	406905
273	Wigan 41	Wigan	41	Darlington Street East, Wigan	RS	35	40.8	38	36.9	33.4	36.8	Y	359161	405460
274	Wigan 42	Wigan	42	Bolton Road, Ashton	RS	38	44.3	40.6	40.8	35.4	39.8	Y	358141	399515
275	Wigan 43	Wigan	43	Marus Bridge Roundabout, Wigan	RS	38	43.4	38.9	40.8	37.3	39.7	Y	356833	403150
276	Wigan 44	Wigan	44	Wigan Road, Hindley	RS	34.2	38.1	32.7	35.3	30.8	34.2	Y	361423	404476
277	Wigan 45	Wigan	45	Queen Street, Wigan	RS	31.9	35.4	32.7	32.6	33.2	33.2	Y	358257	405160
278	Wigan 46	Wigan	46	Standish Centre 1, Standish	RS	28.9	32.8	31.8	28.3	26.4	29.6	Y	356398	409973
279	Wigan 51	Wigan	51	Nu Nu Nursery, Scholes	RS	35	34.6	30	30.9	39.8	34.1	Y	358789	405933

Appendix A

Row	TubeRef	LA	Site id	Site Address	Site Type	2009	2010	2011	2012	2013	09-13 AVG	In AQMA	X	Y
280	Wigan 52	Wigan	52	Church Lane, Lowton (A580)	RS	40.3	46.1	47.7	47.7	27	41.8	Y	362137	396947
281	Wigan 53	Wigan	53	New Miles Lane, Shevington (M6)	RS	33.4	36.3	32.7	32.8	29.8	33.0	Y	353896	408519
282	Wigan 54	Wigan	54	East Lancs. Road, Astley 2 (A580)	RS	38	39	34.4	37.2	33.1	36.3	Y	370613	400583
283	Wigan 55	Wigan	55	Orrell Road 3 , Orrell (M6 Junction)	RS	51.7	56.7	53		35.1	49.1	Y	353931	404899
284	Wigan 56	Wigan	56	Standish Centre 2, Standish	RS	36.5	38.1	36.2	35.3	32.7	35.8	Y	356228	410104
285	Wigan 57	Wigan	57	Pottery Road, Wigan	RS	37.2	40.8	37.1	33.9	31.6	36.1	Y	357742	405208
286	Wigan 58	Wigan	58	Poolstock 1, Wigan	RS	36.5	40.8	37.1	37.3	29.2	36.2	Y	357624	404201
287	Wigan 59	Wigan	59	Poolstock 2, Wigan	RS	36.5	40.8	38		31.9	36.8	Y	357373	403744
288	Wigan 60	Wigan	60	Ormskirk Road, Pemberton	RS	35	39	37.1	37.2	31	35.9	Y	355103	404558
289	Wigan 61	Wigan	61	Atherton Road, Hindley Green	RS	33.4	40.8	36.2	37.8	32.8	36.2	Y	364025	403079
290	Wigan 62	Wigan	62	Orrell Road 2, Orrell (M6)	RS	43.3	48.7	46.8		30.5	42.3	Y	354411	404728
291	Wigan 63	Wigan	63	Newtown, Wigan	RS	32.7	37.2	32.7	31.9	34	33.7	Y	356930	404984
292	Wigan 64	Wigan	64	Cross Street, Hindley	RS	31.2	38.1	36.2	36.1	28.8	34.1	Y	356228	410104
293	Wigan 65	Wigan	65	Liverpool Road, Hindley	RS	33.4	37.2	37.1	37	27.9	34.5	Y	361517	404242
294	Wigan 66	Wigan	66	Leigh Road, Howe Bridge	RS	28.9	37.2	35.3	31.6	27.4	32.1	Y	366347	402353
295	Wigan 67	Wigan	67	Warrington Road Newtown	RS	35.7	36.3	35.3	35.5	38.1	36.2	Y	356820	404663
296	Wigan 68	Wigan	68	Westleigh Lane, Leigh	RS	30.4	32.8	33.6	32.8	24.8	30.9	N	365221	401688

Appendix A

Row	TubeRef	LA	Site id	Site Address	Site Type	2009	2010	2011	2012	2013	09-13 AVG	In AQMA	X	Y
297	Wigan 69	Wigan	69	Scot Lane, Wigan	RS	31.2	39.9	36.2	35.3	24.8	33.5	Y	356257	405960
298	Wigan 70	Wigan	70	Bickershaw Lane, Bickershaw	RS	23.6	30.1	42.4		29.9	31.5	N	362329	402037
299	Wigan 71	Wigan	71	Tyldesley Road, Tyldesley	RS	34.2	40.8	41.5	38	25.7	36.0	Y	368244	402562
300	Wigan 72	Wigan	72	Beech Hill Avenue, Beech Hill	RS		34.6	32.7	26.3	28.5	30.5	Y	356322	407002
301	Wigan 73	Wigan	73	Bolton Road, Atherton 2	RS	26.6	35.4	31.8	28.1	28.6	30.1	Y	368769	403913
302	Wigan 74	Wigan	74	Plank Lane, Leigh	RS	23.6	29.2	26.5		32.1	27.9	N	363606	399851
303	Wigan 75	Wigan	75	Woodhouse Lane, Wigan	RS	30.4	36.3	33.6	34.4	32.7	33.5	N	357093	406378
304	Wigan 76	Wigan	76	Fleet Street, Pemberton	RS	25.1	31	46.8		31.1	33.5	N	354724	404742
305	Wigan 77	Wigan	77	Lily Lane, Bamfurlong	RS	24.3	31.9	29.1	31.5	33.8	30.1	N	359616	401373
306	Wigan 78	Wigan	78	Castle Street Tyldesley	RS	31.2	40.8	37.1	37.4	32.3	35.8	Y	368675	402235
307	Wigan 79	Wigan	79	KittGreen Road, Kitt Green	RS	26.6	32.8	28.3	28.9	30.7	29.5	Y	355291	405930
308	Wigan 80	Wigan	80	Leigh Road, Atherton	RS	27.4	33.7	30.9	29.7	25.1	29.4	Y	366907	402905
309	Wigan 81	Wigan	81	Preston Road Standish	RS	28.9	36.3	33.6	32.1	26.7	31.5	N	355978	410362
310	Wigan 82	Wigan	82	Bryn Road, Ashton	RS	28.1	33.7	30.9	29	42.4	32.8	Y	358339	399752
311	Wigan 83	Wigan	83	Wigan Road Bryn	RS	32.7	38.1	39.7	35.7		36.6	Y	357100	400795
312	Wigan 84	Wigan	84	Westbourne Avenue, Leigh	RS	26.6	33.7	33.6	30.8		31.2	Y	365587	401359
313	Wigan 85	Wigan	85	Chaddock Lane, Astley	RS	28.9	35.4	34.4	34.1		33.2	Y	370608	400786

Appendix A

Row	TubeRef	LA	Site id	Site Address	Site Type	2009	2010	2011	2012	2013	09-13 AVG	In AQMA	X	Y
314	Wigan 86	Wigan	86	Firs Lane, Leigh	RS	31.2	36.3	34.4	33.3		33.8	N	364427	400291
315	Wigan 87	Wigan	87	Manchester Road, Leigh	RS	29.6	39	35.3	36.1		35.0	Y	367128	399718
316	Wigan 88	Wigan	88	Warrington Road, Leigh	RS	31.9	39.9	36.2	32		35.0	Y	366959	399312
317	Wigan 89	Wigan	89	Spring Road, Orrell (M6)	RS	29.6	35.4	34.4	31.4		32.7	Y	353721	405968
318	Wigan 90	Wigan	90	Moor Road, Orrell	RS	33.4	43.4	39.9	40		39.2	N	353381	405004
319	Wigan 91	Wigan	91	Wigan Road Bryn	RS	31.9	36.3	38	35.4		35.4	Y	356897	401353
320	Wigan 92	Wigan	92	High Street Hindsford	RS	28.9	35.4	33.6	32.9		32.7	N	367807	403196
321	Wigan 93	Wigan	93	Wigan Road Atherton	RS	26.6	31	31.8	27.7		29.3	N	366020	402974
322	Wigan 94	Wigan	94	Greendale, Hag Fold (Railway)	RS	23.6	24.8	43.3			30.6	N	368059	403805
323	Wigan 95	Wigan	95	Prescott Lane, Kitt Green	RS	28.9	31.9	30.9	29.9		30.4	N	354716	406032
324	Wigan 96	Wigan	96	Shuttle Street, Tyldesley	RS		53.2	38	47.5		46.2	Y	369246	402142
325	Wigan 97	Wigan	97	Warrington Road Ashton	UC			35.3	50.8		43.1	Y	357673	398999
326	Wigan 98	Wigan	98	Downall Green Road Ashton	UC			37.1	43.8		40.5	Y	356377	400792
327	Wigan 10	Wigan	10	Kennedy house, Leigh	UB	25.1	28.4	25.6	24.4		25.9	N	366290	399861
328	Wigan 19	Wigan	19	Kennedy house, Leigh	UB	25.1	28.4	25.6	24.5		25.9	N	366290	399861
329	Wigan 50	Wigan	50	Kennedy house, Leigh	UB	25.1	28.4	25.6	25.4	29.4	26.8	N	366290	399861
330	Wigan 47	Wigan	47	Wigan Station, Wigan	UB	25.1	27.5	27.4	24.8	22.2	25.4	N	357815	406022

Appendix A

Row	TubeRef	LA	Site id	Site Address	Site Type	2009	2010	2011	2012	2013	09-13 AVG	In AQMA	X	Y	
331	Wigan 48	Wigan	48	Wigan Station, Wigan	UB	25.1	27.5	27.4	25	21.4	25.3	N	357815	406022	
332	Wigan 49	Wigan	49	Wigan Station, Wigan	UB	25.1	27.5	27.4	25.1	20.8	25.2	N	357815	406022	
333	Wigan 113	Wigan	113	500 Warrington Road, Marus Bridge	RS	33.4	37.2	35.3	35.1	31.9	34.6	Y	356693	403389	
334	Wigan 114	Wigan	114	Atherleigh Way, Leigh	RS	39.5	46.1	43.3	44.4	43.2	43.3	Y	365116	400260	
335	Wigan 115	Wigan	115	Winchester Close, Orrell	RS	30.4	34.6	31.8	29.9	30	31.3	Y	353845	405360	
336	Wigan 116	Wigan	116	Hendon Road, Leigh	UB	27.4	25.7	24.7	26.5	21.2	25.1	N	365846	401719	
337	MAN85	MAN	85	85 Church Road	Rs					43.1	42.9	43.0	Y	382883	390062
338	MAN86	MAN	86	86 Longley	Rs					39		39.0	Y	383273	389445
339	MAN87	MAN	87	87 Wilmslow Road	Rs					42.8		42.8	Y	384945	392565
340	#N/A	TAMESIDE	#N/A	#N/A	#N/A					16.4	17.9	17.2	#N/A	#N/A	#N/A
341	BOLTON65	BOLTON	65	65 2 Phoenix St Bolton	UB					32.4	29	30.7	Y	372059	409877
342	#N/A	TAMESIDE	#N/A	#N/A	#N/A					16.4	17.9	17.2	#N/A	#N/A	#N/A
343	TAMESIDET 38	TAMESIDE	T 38	0	0						33	33.0	0		
344	TAMESIDET 39	TAMESIDE	T 39	0	0						38.7	38.7	0		
345	TAMESIDET 40	TAMESIDE	T 40	0	0						31.2	31.2	0		

Appendix A

Row	TubeRef	LA	Site id	Site Address	Site Type	2009	2010	2011	2012	2013	09-13 AVG	In AQMA	X	Y
346	TAMESIDET 41	TAMESIDE	T 41	0	0					30.5	30.5	0		
347	TAMESIDET 42	TAMESIDE	T 42	0	0					29.3	29.3	0		
348	TAMESIDET 43	TAMESIDE	T 43	0	0					38.1	38.1	0		
349	TAMESIDET 44	TAMESIDE	T 44	0	0					11.3	11.3	0		
350	Wigan 117	Wigan	117	0	0					26.2	26.2	0		
351	SalfordSA4 9	Salford	SA49	Parrin Lane	RS						#DIV/0!	Y	375736	399358
352	SalfordSA4 0	Salford	SA40	Rooke St	RS					40.1	40.1	Y	375394	397806
353	SalfordSA5 1	Salford	SA51	Liverpool Rd (Claybank)	RS					35.6	35.6	Y	375212	397664
354	SalfordSA5 2	Salford	SA52	Sealand Road	RS					34.6	34.6	Y	375148	397589
355	SalfordSA5 3	Salford	SA53	Ryecroft Lane o/s 41 (r Ednfld La)	UB					44.7	44.7	Y	374756	399894
356	SalfordSA5 4	Salford	SA54	Ryecroft lane o/s5/7 (nr Gran La)	UB					28.7	28.7	Y	374899	399983

Appendix B

Appendix B

Appendix B: Model Uncertainty

Performance of the GMEDIS model was evaluated by TfGM using statistical procedures following Defra guidance^{22,23} and model performance was found to be acceptable. Uncertainty calculations are provided below, taken from the TfGM report on the GMEDIS Model 2010 Year¹².

Table B1 2010 Annual Monitored and Modelled Total NO₂ µg.m⁻³ concentrations

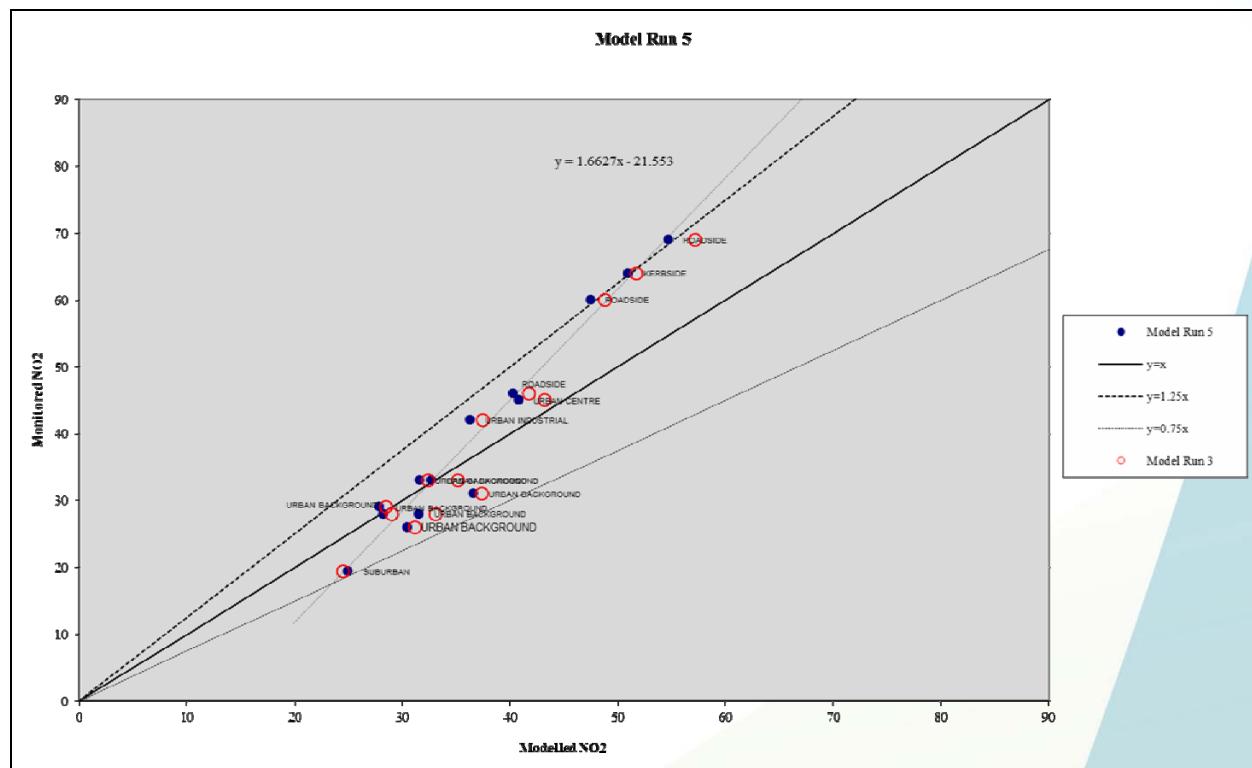
Annual monitored and modelled NO ₂ concentrations					
Monitoring Site	Type	Monitored NO ₂ (µg/m ³)	Modelled NO ₂ (µg/m ³)	% Difference	Fractional Bias
Bolton College	Urban Background	28	31.50	12.51	-0.11774
Bury Roadside	Roadside	69	54.68	-20.75	0.23156
Glazebury	Suburban	19.4	24.91	28.41	-0.24876
Manchester Oxford Road	Kerbside	64	50.94	-20.40	0.22717
Manchester Piccadilly	Urban Centre	45	40.81	-9.32	0.09774
Manchester South	Urban Background	28	28.22	0.80	-0.00800
Oldham West Endhouse	Urban Background	33	32.68	-0.96	0.00969
Salford Eccles	Urban Industrial	42	36.27	-13.63	0.14629
Salford M60	Roadside	60	47.46	-20.89	0.23331
Stockport Shaw Heath	Urban Background	31	36.56	17.95	-0.16472
Trafford A56	Roadside	46	40.27	-12.45	0.13278
Trafford	Urban Background	33	31.61	-4.21	0.04300
Wigan Centre	Urban Background	26	30.48	17.23	-0.15862
Wigan Leigh 2	Urban Background	29	27.89	-3.83	0.03903

²² Defra, June 2010, *Evaluating the Performance of Air Quality Models Issue 3*.

²³ Defra, February 2009, *Local Air Quality Management Technical Guidance LAQM.TG.(09)*.

Appendix B

Figure B1 Comparison of annual monitored and modelled NO₂ concentrations



The results show a slight under-prediction of NO₂ values at higher concentrations, in this case at roadside sites adjacent to motorways and at a kerbside next to a radial route in the city centre. It is thought that the emissions inventory data won't be accurately representing the speeds due to flow breakdown on the motorway and standing traffic, mainly buses, at the kerbside site. It also seems to be slightly over predicting at the lowest monitored concentration, Glazebury. The model will be over predicting to a certain extent, due to a small amount of double counting because Glazebury is the source of the background data.

As a measure of the departure between modelled concentrations (M_i) and observed concentrations (O_i) the mean bias, MB, and the mean gross error, MGE, are calculated as follows:

$$MB = \left(\sum_i (M_i - O_i) \right) / N = -2.792 \mu\text{g}/\text{m}^3$$

$$MGE = \left(\sum_i |M_i - O_i| \right) / N = 5.547 \mu\text{g}/\text{m}^3$$

The relative difference between model predictions and observations can be measured by calculating the normalised mean bias, NMB, and the normalised mean gross error, NMGE.

Appendix B

$$NMB = (\sum_i M_i - O_i) / \sum_i O_i = -0.0706$$

$$NMGE = (\sum_i |M_i - O_i|) / \sum_i O_i = 0.1403$$

The Defra guidance for evaluating the performance of air quality models²⁴ suggests that air quality models are considered acceptable if NMB values lie within the range between -0.2 and +0.2, based on many years modelling experience over a wide range of pollutants of policy relevance.

The guidance also suggests that a count of the fraction of points within ½ and 2 times the monitored values, FAC2, is as a useful evaluation metric.

FAC2 is defined as the fraction of modelled values that satisfy:

$$0.5 \leq M_i / O_i \leq 2.0$$

It recommends that an air quality model is considered acceptable if more than half or the model predictions lie within a factor of 2 of the observations. All of our model results lie within a factor of two. In fact, the majority of modelled values lie within ±25% of the observed value.

The Root Mean Square Error (RMSE) is another statistic used to define the average error or uncertainty of the model.

$$RMSE = \sqrt{(\sum_i (O_i - M_i)^2 / N)} = 7.136 \mu\text{g}/\text{m}^3$$

The RMSE should be within 25% of the annual mean NO₂ objective and ideally within 10%. In this case, we are looking at the 40 µg/m³ objective so the value of 7.136 µg/m³ compares well with the expected figure of ±10 µg/m³. The value 7.136 µg/m³ is influenced by the modelled results for Bury Roadside, Salford M60 and Manchester Oxford Road. If these three sites are removed from the calculation then the RMSE becomes 4.047 µg/m³.

Fractional bias, FB, is used to identify if the model shows a systematic tendency to over or under predict.

$$FB = (\bar{O} - \bar{M}) / 0.5 (\bar{O} + \bar{M}) = 0.073$$

where \bar{O} = the average of all observed concentrations

\bar{M} = the average of all modelled concentrations

FB values vary between +2 and -2 and has an ideal value of zero. Negative values suggest a model over-prediction and positive values suggest a model under-prediction. The value of 0.073 is close to the ideal value of zero but is showing a slight model under-prediction.

The correlation coefficient, r, is a measure of the linear relationship between predicted and observed data. A value of zero means no relationship and a value of 1 means that the model is capable of accounting for all the variation in the observed data.

$$r = \frac{\sum_i (O_i - \bar{O})(M_i - \bar{M})}{\sqrt{(\sum_i O_i^2)(\sum_i M_i^2)}} = 0.978$$

where \bar{O} = the average of all observed concentrations

²⁴ Defra (2010) Evaluating the Performance of Air Quality Models, June 2010, Issue 3.

Appendix B

M = the average of all modelled concentrations

Finally, the model uncertainty, U, has been calculated and the standard deviation for the model, SDM, calculated.

$$U = \frac{SD}{\bar{O}} = 0.090$$

where SD = the standard deviation

\bar{O} = the average of all observed concentrations

$$SDM = U * Co = 3.60$$

where Co = the concentration of the air quality objective under consideration i.e. $40 \mu\text{g}/\text{m}^3$

Appendix B: Model Verification

The ADMS-Urban model was used to predict NO₂ directly and a comparison of modelled and monitored Total NO₂ concentrations for 2010 (from automatic and diffusion tube monitoring sites) was made following Defra guidance¹⁸ (Box A3.5 of TG.09 (Appendix A3)). Monitored Total NO₂ concentrations were taken from sites with data capture of 90% or more. The comparison of modelled and monitored Total NO₂ concentrations is shown **Table B2** below.

The model under predicted NO₂ concentrations at 69% of sites and over predicted concentrations at 31% of sites. However, the majority of modelled results were within 25% of monitored concentrations and therefore model results were not adjusted **Table B3**.

Appendix B

Table B2 Comparison of Modelled and Monitored Total NO₂ µg.m⁻³ Concentrations 2010 (monitoring sites with 90%+ data capture)

Site Address	Site id	Monitor Type	Site Type	Modelled Total NO ₂	Monitored Total NO ₂	% Difference [(modelled - monitored) / monitored] x 100
66 505 Blackburn Rd	66	DT	Ks	37.4	48.9	-23.5
Cheetham Hill Road	22	DT	Ks	43.0	47.0	-8.5
Oldham Road	23	DT	Ks	43.5	48.0	-9.3
Rochdale Road	36	DT	Ks	39.3	45.0	-12.7
Stockport Road	75	DT	Ks	45.0	56.0	-19.6
Car Street, Platt Bridge	21	DT	KS	31.4	33.7	-6.8
Salford M60 Cal Club	N/A	CM	Rs	47.5	60.0	-20.9
Bury Roadside AURN	N/A	CM	Rs	54.7	69.0	-20.8
52 Front 3 Turton Rd Bromley X	52	DT	Rs	35.1	40.8	-13.9
43 Beehive PH Chorley New Rd, Horwich	43	DT	Rs	32.4	40.2	-19.2
40 Bolton Rd/Manchester Rd, W/H	40	DT	Rs	31.6	38.1	-17.0
3 Quintins 329 Derby St	3	DT	Rs	32.8	46.0	-28.8
61 Primrose St Kearsley	61	DT	Rs	43.8	43.3	1.2
64 Bolton Gate	64	DT	Rs	35.3	31.1	13.6
M56	13	DT	Rs	38.5	58.0	-33.7
Princess Road	37	DT	Rs	40.6	54.0	-24.8
Great Ancoats Street	71	DT	Rs	44.2	50.0	-11.6
Hyde Road	73	DT	Rs	55.1	49.0	12.5
Kingsway	74	DT	Rs	36.0	45.0	-20.0
Alma Road	80	DT	Rs	32.7	40.0	-18.4

Appendix B

Site Address	Site id	Monitor Type	Site Type	Modelled Total NO ₂	Monitored Total NO ₂	% Difference [(modelled - monitored) / monitored] x 100
52 Cherrington Drive Caslteton	3A	DT	Rs	34.9	31.6	10.7
Mossway Middleton	5A	DT	Rs	39.7	28.2	41.2
Heywood Old Rd Birch	6A	DT	Rs	62.4	47.6	31.0
Manchester Old Rd Rochdale	8A	DT	Rs	37.9	50.0	-24.2
Manchester Rd Rochdale	9A	DT	Rs	38.6	55.5	-30.4
Whitworth Road Rochdale	11A	DT	Rs	46.6	50.8	-8.3
M62 Depot Milnrow	15A	DT	Rs	37.3	34.0	9.7
Civicentre Hazel Grove	SK 7	DT	Rs	36.7	52.0	-29.5
Norwood Road	SK11	DT	Rs	38.7	45.0	-13.9
A34 Kingsway	SK12	DT	Rs	37.5	66.0	-43.2
Bramhall Lane	SK15	DT	Rs	37.0	42.0	-11.8
Stockport Rd. Bredbury	SK16	DT	Rs	35.1	34.0	3.2
Gorton Road	SK19	DT	Rs	39.4	47.0	-16.3
Finney Lane	SK28	DT	Rs	34.4	49.0	-29.7
Park Parade Ashton	T 14	DT	Rs	41.9	34.6	21.2
Manchester Road Droylsden	T 17	DT	Rs	36.6	35.2	3.9
Manchester Road Crown Point	T 19	DT	Rs	46.7	41.3	13.0
Shevington Moor, Standish	2	DT	RS	33.7	33.7	0.1
Linden Court, Orrell	3	DT	RS	32.1	37.2	-13.8
Orrell Road 3, Orrell (M6)	55	DT	RS	34.5	39.0	-11.5
Parkside Crescent, Orrell (M6)	5	DT	RS	40.4	39.0	3.7

Appendix B

Site Address	Site id	Monitor Type	Site Type	Modelled Total NO ₂	Monitored Total NO ₂	% Difference [(modelled - monitored) / monitored] x 100
Twist Lane, Leigh	6	DT	RS	35.1	39.0	-10.1
Old Hall Drive 2, Ashton (M6)	7	DT	RS	35.8	43.4	-17.5
Queens Arms Hotel, Astley (A580 Juction)	8	DT	RS	38.3	45.2	-15.2
Warrington Road, Hawkley, Wigan	9	DT	RS	35.4	47.8	-26.0
Atherton Road, Hindley	15	DT	RS	28.7	39.0	-26.3
Manchester Road, Tyldesley 3	0	DT	RS	32.5	43.4	-25.1
East Lancs. Road, Astley 1(A580)	0	DT	RS	32.5	47.0	-30.8
Fire Station, Newtown	22	DT	RS	34.0	34.6	-1.7
Atherton Road, Hindley	0	DT	RS	34.9	43.4	-19.6
Walthew Lane, Platt Bridge	25	DT	RS	29.2	38.1	-23.5
Ladies Lane, Hindley	27	DT	RS	28.8	30.1	-4.5
Walmsley Street, Wigan	29	DT	RS	37.5	42.5	-11.9
Smiths Lane, Hindley Green	30	DT	RS	29.9	31.0	-3.4
Manchester Road, Tyldesley 2	31	DT	RS	32.3	40.8	-20.7
The Oval 2, Shevington (M6)	32	DT	RS	36.5	38.1	-4.1
Rydal Street, Leigh	34	DT	RS	33.6	40.8	-17.6
Woodfield Crescent, Ashton (M6)	35	DT	RS	35.7	43.4	-17.7
Smallshaw Crescent, Ashton	36	DT	RS	29.1	35.4	-18.0
Ashwood Avenue 3, Ashton (M6)	38	DT	RS	38.6	44.3	-12.8
Ashwood Avenue 1, Ashton (M6)	39	DT	RS	33.4	46.1	-27.4
Whalley 2, Wigan	40	DT	RS	31.9	35.4	-10.1

Appendix B

Site Address	Site id	Monitor Type	Site Type	Modelled Total NO ₂	Monitored Total NO ₂	% Difference [(modelled - monitored) / monitored] x 100
Darlington Street East, Wigan	41	DT	RS	34.3	40.8	-15.9
Bolton Road, Ashton	42	DT	RS	29.6	44.3	-33.2
Marus Bridge Roundabout, Wigan	43	DT	RS	34.4	43.4	-20.8
Wigan Road, Hindley	44	DT	RS	33.7	38.1	-11.6
Queen Street, Wigan	45	DT	RS	39.1	35.4	10.4
Standish Centre 1, Standish	46	DT	RS	28.9	32.8	-11.9
Church Lane, Lowton (A580)	52	DT	RS	34.6	46.1	-25.0
New Miles Lane, Shevington (M6)	53	DT	RS	35.6	36.3	-2.1
East Lancs. Road, Astley 2 (A580)	54	DT	RS	30.6	39.0	-21.6
Orrell Road 3 , Orrell (M6 Junction)	55	DT	RS	43.3	56.7	-23.6
Standish Centre 2, Standish	56	DT	RS	33.4	38.1	-12.2
Pottery Road, Wigan	57	DT	RS	38.6	40.8	-5.4
Poolstock 1, Wigan	58	DT	RS	32.0	40.8	-21.4
Poolstock 2, Wigan	59	DT	RS	31.4	40.8	-22.9
Ormskirk Road, Pemberton	60	DT	RS	36.1	39.0	-7.3
Atherton Road, Hindley Green	61	DT	RS	35.3	40.8	-13.3
Orrell Road 2, Orrell (M6)	62	DT	RS	34.0	48.7	-30.1
Newtown, Wigan	63	DT	RS	35.6	37.2	-4.4
Cross Street, Hindley	64	DT	RS	33.4	38.1	-12.2
Leigh Road, Howe Bridge	66	DT	RS	32.4	37.2	-12.9
Warrington Road Newtown	67	DT	RS	33.4	36.3	-7.9

Appendix B

Site Address	Site id	Monitor Type	Site Type	Modelled Total NO ₂	Monitored Total NO ₂	% Difference [(modelled - monitored) / monitored] x 100
Westleigh Lane, Leigh	68	DT	RS	32.0	32.8	-2.5
Scot Lane, Wigan	69	DT	RS	34.3	39.9	-14.0
Bickershaw Lane, Bickershaw	70	DT	RS	28.3	30.1	-6.1
Tyldesley Road, Tyldesley	71	DT	RS	30.7	40.8	-24.7
Bolton Road, Atherton 2	73	DT	RS	31.8	35.4	-10.4
Plank Lane, Leigh	74	DT	RS	27.0	29.2	-7.7
Woodhouse Lane, Wigan	75	DT	RS	34.9	36.3	-4.0
Fleet Street, Pemberton	76	DT	RS	29.4	31.0	-5.1
Lily Lane, Bamfurlong	77	DT	RS	28.1	31.9	-11.9
Castle Street Tyldesley	78	DT	RS	38.5	40.8	-5.4
KittGreen Road, Kitt Green	79	DT	RS	28.5	32.8	-13.2
Leigh Road, Atherton	80	DT	RS	28.4	33.7	-15.6
Preston Road Standish	81	DT	RS	27.4	36.3	-24.6
Bryn Road, Ashton	82	DT	RS	31.1	33.7	-7.6
Wigan Road Bryn	83	DT	RS	30.3	38.1	-20.5
Westbourne Avenue, Leigh	84	DT	RS	30.2	33.7	-10.3
Chaddock Lane, Astley	85	DT	RS	30.7	35.4	-13.4
Firs Lane, Leigh	86	DT	RS	28.4	36.3	-21.7
Manchester Road, Leigh	87	DT	RS	30.5	39.0	-21.7
Warrington Road, Leigh	88	DT	RS	29.6	39.9	-25.8
Spring Road, Orrell (M6)	89	DT	RS	36.3	35.4	2.3

Appendix B

Site Address	Site id	Monitor Type	Site Type	Modelled Total NO ₂	Monitored Total NO ₂	% Difference [(modelled - monitored) / monitored] x 100
Moor Road, Orrell	90	DT	RS	28.9	43.4	-33.5
Wigan Road Bryn	91	DT	RS	31.6	36.3	-13.0
High Street Hindsford	92	DT	RS	33.5	35.4	-5.4
Wigan Road Atherton	93	DT	RS	30.8	31.0	-0.8
Greendale, Hag Fold (Railway)	94	DT	RS	27.5	24.8	10.8
Prescott Lane, Kitt Green	95	DT	RS	26.7	31.9	-16.2
500 Warrington Road, Marus Bridge	113	DT	RS	32.1	37.2	-13.6
Winchester Close, Orrell	115	DT	RS	35.1	34.6	1.5
Hey Bottom Calderbrook	14A	DT	RU	23.9	14.7	62.3
Compstall Library	SK 4	DT	Ru	26.4	18.0	46.8
Manchester South AURN	N/A	CM	SU	28.2	28.0	0.8
Bolton College Cal Club	N/A	CM	UB	31.5	28.0	12.5
Wigan Leigh 2 Cal Club	N/A	CM	UB	27.9	29.0	-3.8
Stockport Shaw Heath AURN	N/A	CM	UB	36.6	31.0	17.9
Wigan Centre AURN	N/A	CM	UB	30.5	26.0	17.2
48 Ainsworth Road, Little Lever	48	DT	UB	35.5	31.4	13.0
49 Council area office little lever	49	DT	UB	31.0	25.6	21.2
53 Rear 3 Turton Rd Bromley X	53	DT	UB	31.6	21.9	44.2
54 20 Laburnam Pk Bromley X	54	DT	UB	27.4	17.7	55.0
44 1007 Chorley New Rd, Horwich	44	DT	UB	29.9	28.4	5.4
46 5 Crowborough Close Horwich	46	DT	UB	26.4	16.5	59.4

Appendix B

Site Address	Site id	Monitor Type	Site Type	Modelled Total NO ₂	Monitored Total NO ₂	% Difference [(modelled - monitored) / monitored] x 100
63 2 Fern St	63	DT	UB	32.6	30.1	8.2
65 2 Phoenix St Bolton	65	DT	UB	33.0	32.3	2.4
67 3 the Welland	67	DT	UB	27.7	27.6	0.5
68 24 Winslow rd	68	DT	UB	30.0	32.9	-8.8
16 Drummond St, Astley Bridge	16	DT	UB	29.8	21.0	41.7
Lockton Close	72	DT	UB	42.6	45.0	-5.3
Clayton Lane	76	DT	UB	34.0	38.0	-10.6
Rostron Avenue	78	DT	UB	38.6	42.0	-8.0
Victoria Terrace	79	DT	UB	35.9	38.0	-5.6
Peaceville Road	81	DT	UB	32.4	33.0	-1.8
Mere Lane Rochdale	1A	DT	UB	31.2	30.3	2.8
Holmes Street Rochdale	10A	DT	UB	28.8	21.3	35.7
725 Halifax Road Wardle	13A	DT	UB	32.6	20.4	59.6
Ashfield Road Milnrow	16A	DT	UB	33.0	32.0	3.2
Kingsway Rochdale	17A	DT	UB	33.6	26.8	25.4
SA1 Irlam Locks	SA1	DT	UB	28.2	32.2	-12.5
Whitehill Firestation	SK 1	DT	UB	30.6	26.0	17.7
Denby Lane	SK 3	DT	UB	33.0	31.0	6.4
Marshalls Yard Hazel Grove	Sk 8	DT	UB	32.1	27.0	19.0
Alderley Close Hazel Grove	Sk 9	DT	UB	25.8	18.0	43.1
Deneside Cres. Hazel Grove	SK10	DT	UB	26.8	20.0	33.8

Appendix B

Site Address	Site id	Monitor Type	Site Type	Modelled Total NO ₂	Monitored Total NO ₂	% Difference [(modelled - monitored) / monitored] x 100
Prospect Vale	SK13	DT	UB	27.7	22.0	25.7
Upton Ave.	SK14	DT	UB	28.0	20.0	40.0
Yew Street	SK17	DT	UB	35.6	34.0	4.8
Carmichael Street	SK21	DT	UB	31.2	30.0	4.1
Pinewood Close	SK27	DT	UB	29.7	24.0	23.8
Russell Street	SK29	DT	UB	29.9	24.0	24.7
Kennedy house, Leigh	10	DT	UB	27.9	28.4	-1.8
Hendon Road, Leigh	116	DT	UB	27.6	25.7	7.4
Manchester Piccadilly AURN	N/A	CM	UC	40.8	45.0	-9.3
Oldham West Endhouse Cal Club	N/A	CM	UC	32.7	33.0	-1.0
62 72/74 Hr Market St	62	DT	UC	37.1	46.6	-20.2
Hewitt Street	77	DT	UC	45.1	49.0	-7.9
Middleton Library	4A	DT	UC	33.4	35.0	-4.3
Edinburgh Way Rochdale	7A	DT	UC	43.6	39.2	11.2
Debenhams	SK18	DT	UC	49.7	46.0	8.1
Satinwood Close 2, Ashton (M6)	37	DT	UC	33.1	41.6	-20.6

Table B3 Summary of Comparison between Modelled and Monitored Total NO₂ µg.m⁻³ 2010 Concentrations

Appendix B

Difference between modelled and monitored NO ₂ concentrations	Total number of sites
Within +/-10%	61
Within +/- 25%	75
Greater than 25%	26
TOTAL NUMBER OF SITES	162

Appendix B

Appendix B: Predicted NO₂ concentrations 2010 and 2016

Table B4 Predicted Total NO₂ concentrations at Receptor Points 2010

Receptor Number	Annual Mean Total NO ₂ average	NO ₂ hourly 99.79 percentile value	NO ₂ number of exceedances	NO _x average(µg/m ³)
1	52.68	201.30	19	168.92
3	50.94	190.56	16	153.78
4	32.64	136.45	0	69.00
5	28.74	142.83	1	56.97
6	28.62	142.90	1	56.99
7	34.69	142.76	1	72.44
8	36.48	139.41	1	81.55
9	33.70	144.70	1	74.45
10	34.99	139.18	1	73.89
11	31.05	142.18	1	62.08
12	36.63	149.71	2	79.98
13	35.03	149.31	2	74.08
14	34.26	138.25	1	72.27
15	33.00	147.05	1	69.32
16	33.37	139.43	1	68.60
17	35.59	136.61	0	74.82
18	31.90	143.97	1	64.63
19	43.08	152.16	2	111.94
20	43.68	163.73	2	112.54
21	34.95	142.18	1	77.35
23	32.58	143.70	1	68.56
24	33.17	148.63	2	69.55
25	42.13	157.67	1	102.80
26	35.19	154.36	2	80.94
27	39.40	144.00	1	89.33
28	39.17	145.33	1	88.67
29	37.39	159.67	3	87.27
30	29.57	138.32	1	63.43
31	31.22	141.31	1	63.97

Appendix B

32	34.78	144.04	1	72.71
33	33.23	143.95	1	66.85
34	36.62	151.75	2	80.85
35	41.82	161.41	4	100.48
36	34.80	147.45	2	73.64
37	37.08	151.16	2	82.45
38	30.99	133.32	0	62.34
39	30.72	133.84	0	61.28
40	31.29	129.85	0	61.72
41	31.30	136.50	1	62.02
42	29.25	140.96	1	58.13
43	29.96	139.32	1	59.40
44	37.34	146.12	1	81.98
45	33.07	144.70	1	69.39
46	35.41	140.10	1	77.64
47	34.77	135.19	0	71.85
48	30.50	132.57	0	60.21
49	32.95	144.97	1	68.04
51	33.04	138.82	1	67.85
52	32.95	142.88	1	68.64
53	31.50	133.37	0	62.70
54	32.31	133.99	0	66.53
55	31.64	137.28	1	65.18
56	32.78	142.97	1	67.86
57	30.32	134.27	1	60.04
58	30.49	138.85	1	61.54
59	32.06	134.83	0	65.00
60	30.19	139.45	1	59.01
61	32.60	135.20	0	66.83
62	37.67	142.93	0	86.28
64	31.94	135.91	0	64.95
65	31.95	135.93	0	65.01
66	31.15	141.40	1	62.35

Appendix B

67	37.37	145.71	1	82.09
68	31.07	134.19	0	62.44
69	32.59	136.41	0	67.31
70	32.87	138.80	0	69.02
71	31.59	132.58	0	63.08
72	31.16	143.43	1	63.22
74	31.20	142.96	1	61.51
75	30.93	134.98	1	61.23
76	33.14	134.72	1	67.38
77	30.86	142.57	1	61.93
78	32.45	144.43	1	67.02
79	28.19	137.00	1	54.16
80	31.01	131.98	0	62.11
81	33.06	138.74	1	67.26
82	29.70	145.42	1	58.88
83	32.10	131.61	0	64.48
84	29.60	146.39	1	59.18
86	28.37	146.37	1	55.94
87	31.51	130.20	0	62.99
88	32.09	137.89	1	65.21
89	29.91	145.92	1	59.31
90	39.49	167.44	3	95.62
91	31.92	134.24	0	64.47
92	29.45	141.15	1	57.67
93	31.04	137.10	1	62.26
94	34.38	138.39	0	72.31
95	33.24	138.95	1	67.30
96	31.28	133.60	0	62.70
97	31.42	132.18	0	62.33
98	31.49	132.92	0	62.92
99	32.75	136.47	0	67.48
100	28.42	138.19	1	54.76
101	32.58	133.67	1	66.67

Appendix B

102	30.60	133.08	0	60.38
103	29.61	138.68	1	57.83
104	33.27	142.88	1	68.52
105	30.39	142.03	1	60.36
106	32.95	140.02	1	67.37
107	31.45	139.12	1	62.72
108	33.72	137.89	1	69.17
109	33.85	139.12	0	69.67
110	31.13	141.64	1	62.54
111	32.14	142.95	1	65.20
112	31.88	134.90	0	65.24
113	35.38	136.63	0	74.01
114	33.51	137.81	1	71.45
115	31.67	142.38	1	64.89
116	39.17	152.00	2	88.40
117	34.45	141.82	0	74.26
118	30.54	128.79	0	60.03
119	30.59	142.83	1	59.95
120	35.37	147.85	1	75.46
121	35.50	136.94	1	80.17
122	32.83	132.13	0	70.02
123	31.41	135.46	0	62.80
124	33.74	142.18	1	69.81
125	31.61	139.59	1	63.31
126	29.82	140.25	1	58.88
127	29.47	141.35	1	57.56
128	35.98	137.50	1	75.79
129	32.29	134.28	1	65.36
130	38.45	144.85	1	87.12
131	32.27	132.56	0	65.75
132	36.05	139.06	1	78.28
133	30.41	134.25	1	59.69
134	29.31	145.90	1	58.00

Appendix B

135	29.64	140.87	1	58.07
136	30.73	137.01	1	61.01
137	31.68	143.50	1	62.82
138	32.43	135.77	1	66.56
139	36.26	140.22	1	80.58
140	31.96	136.07	0	64.56
141	31.61	131.73	0	63.29
142	31.11	137.95	1	61.14
143	29.64	141.42	1	58.35
144	29.07	145.65	1	57.68
145	32.03	140.55	1	65.81
146	31.59	133.76	1	63.29
147	30.39	133.37	0	59.72
148	35.55	139.77	0	76.28
149	34.96	146.61	1	75.11
150	30.53	144.59	1	61.02
151	31.42	142.70	1	63.79
152	30.99	130.24	0	61.50
153	32.44	138.56	1	65.95
154	31.25	130.61	0	61.73
155	30.31	132.06	0	59.79
156	31.81	133.99	0	64.01
157	29.21	139.16	1	57.03
158	31.15	134.07	0	61.74
159	32.39	134.48	1	65.57
160	31.20	141.57	1	62.43
161	29.83	145.71	1	59.09
162	33.52	136.10	0	70.87
163	31.44	128.99	0	63.19
164	35.08	145.89	1	75.29
165	31.16	143.89	1	62.82
166	31.31	131.91	0	61.70
167	31.54	132.97	0	62.86

Appendix B

168	30.39	137.56	1	60.04
169	33.33	139.87	1	68.90
170	36.09	148.73	2	83.33
171	30.75	140.95	1	61.18
172	30.34	132.77	0	59.78
173	32.14	142.97	1	64.15
174	31.41	132.46	1	62.91
175	32.23	138.35	1	64.69
176	30.99	138.32	1	63.36
177	30.97	144.22	1	61.16
178	32.07	145.58	1	66.86
179	29.16	140.11	1	57.98
180	35.95	148.87	1	88.88
182	31.83	138.87	1	64.25
183	33.24	148.30	2	71.24
186	30.30	133.59	0	59.69
187	38.69	142.09	1	88.58
188	31.90	138.87	1	64.50
189	30.47	133.31	0	59.97
190	30.89	131.38	0	60.84
191	31.11	134.33	0	62.61
192	31.85	143.54	1	65.34
193	31.28	139.86	1	62.96
194	30.37	131.00	1	59.55
195	31.87	134.43	0	64.17
197	29.62	139.98	1	59.65
198	30.30	133.59	0	59.68
199	30.31	130.39	0	59.05
200	31.06	142.72	1	62.49
201	32.93	148.00	1	67.67
202	31.86	138.28	1	65.21
203	31.43	133.23	0	63.01
204	31.00	137.65	1	61.38

Appendix B

205	35.62	144.73	1	76.25
206	32.35	133.86	0	65.64
207	32.66	139.05	1	69.30
210	43.03	158.71	4	112.06
214	33.96	138.29	0	70.79
215	44.20	151.40	2	107.95
216	45.14	168.04	3	118.87
217	55.13	232.47	60	162.28
218	35.98	144.99	1	79.86
219	39.84	156.48	2	92.74
220	42.60	161.12	2	102.32
221	38.46	156.22	2	89.32
224	43.52	177.18	6	114.74
226	32.42	136.63	1	66.49
228	40.59	156.80	2	98.67
230	39.28	154.53	1	96.67
231	38.63	141.83	1	95.23
232	31.04	141.45	1	63.36
233	45.03	171.81	4	122.97
234	24.73	132.95	1	46.72
236	35.87	138.24	1	82.07
237	37.82	166.40	3	87.29
238	42.45	185.83	9	105.79
239	37.89	147.98	1	83.79
240	44.73	168.97	6	111.30
247	30.60	141.37	0	68.75
248	31.37	136.80	0	66.86
249	33.52	151.36	1	81.80
250	26.36	127.66	0	53.03
251	28.98	135.17	0	63.51
252	34.33	146.93	1	76.41
253	41.71	164.28	3	109.21
254	33.88	142.50	1	73.19

Appendix B

255	38.49	150.31	0	90.91
256	31.73	132.27	0	66.08
257	29.39	128.71	0	57.27
258	31.53	138.00	0	66.35
259	31.50	133.69	0	64.27
260	31.61	131.66	0	62.57
261	36.02	136.70	0	76.15
262	31.18	130.76	0	62.21
263	29.30	133.03	0	59.55
264	33.62	141.65	1	74.39
265	43.58	183.87	6	108.66
266	33.96	138.13	0	74.85
267	32.74	131.31	0	66.08
268	37.30	150.24	2	86.60
269	31.16	131.70	0	68.95
270	32.55	148.36	1	76.77
271	26.74	126.75	0	53.08
272	28.83	128.31	0	56.97
273	46.59	186.17	8	124.83
274	33.43	133.01	0	71.46
275	62.37	258.64	184	189.05
277	38.59	159.07	2	95.26
278	32.96	141.39	0	70.85
279	28.12	125.36	0	53.94
280	33.60	139.99	0	76.49
281	43.33	170.68	3	108.02
282	34.93	141.37	0	73.13
283	39.74	144.99	1	89.92
284	37.90	156.17	1	91.25
285	23.86	122.86	0	44.91
286	29.62	129.58	0	60.08
287	33.79	137.11	1	72.54
288	32.63	138.00	0	70.03

Appendix B

289	28.25	125.59	0	54.56
290	29.78	131.03	0	59.44
291	28.57	127.37	0	55.04
292	31.00	130.29	0	62.21
293	33.49	136.98	0	71.42
294	32.48	133.55	0	70.59
295	38.39	161.11	2	90.20
296	30.21	130.56	0	61.17
297	34.67	149.42	1	80.71
298	30.20	133.67	0	62.11
299	28.22	127.60	0	55.74
300	32.87	135.84	0	71.51
301	34.05	141.91	1	76.26
302	32.74	138.24	0	69.61
303	31.18	134.38	0	63.91
304	30.82	131.62	0	62.06
305	30.19	130.95	0	59.82
306	30.17	128.19	0	60.10
307	31.70	131.75	0	64.16
308	30.15	130.24	0	59.47
309	31.12	130.81	0	62.56
311	31.10	131.03	0	63.39
312	30.61	128.50	0	61.75
313	36.30	152.23	1	85.16
314	30.09	131.62	0	61.90
315	25.33	125.23	0	49.05
316	30.86	131.16	0	63.66
317	32.51	134.00	0	75.16
318	30.91	136.67	0	64.64
319	28.66	132.50	0	61.05
320	29.05	137.92	0	65.17
321	25.66	123.98	0	49.48
322	25.35	124.30	0	48.37

Appendix B

323	26.85	128.85	0	54.94
324	24.92	123.40	0	46.73
325	26.54	128.19	0	53.82
326	30.58	141.26	0	70.60
327	25.75	124.15	0	49.64
328	27.81	131.27	0	58.03
329	30.90	141.50	0	71.81
330	27.40	129.19	0	56.28
331	29.18	132.85	0	61.85
332	29.26	136.09	0	62.22
333	30.19	134.83	0	66.78
334	25.49	123.67	0	48.87
335	26.91	125.80	0	55.32
336	26.07	124.58	0	51.45
337	26.38	128.49	0	51.63
338	27.30	130.81	0	55.49
339	25.38	123.97	0	48.12
340	26.60	128.58	0	53.08
341	27.35	130.70	0	57.75
342	25.27	124.70	0	48.05
343	25.42	123.72	0	48.46
344	28.67	128.12	0	58.62
345	32.16	139.55	0	70.62
346	34.04	140.37	0	77.43
347	29.88	130.09	0	60.77
348	30.25	132.86	0	62.09
349	28.63	127.96	0	55.96
350	35.13	142.30	0	82.17
351	30.17	128.80	0	61.04
352	34.82	140.39	0	79.52
353	30.33	130.48	0	60.64
354	29.77	127.93	0	58.07
355	29.69	126.98	0	57.96

Appendix B

357	28.71	125.38	0	55.59
358	33.00	138.71	0	70.79
359	26.74	124.15	0	50.51
360	28.26	128.40	0	57.53
361	27.94	127.89	0	55.84
362	29.30	132.22	0	62.16
363	30.77	135.31	0	64.22
364	30.91	134.04	0	67.91
365	29.90	131.15	0	62.66
366	30.50	134.17	0	63.79
368	30.70	132.55	0	63.62
369	31.05	135.11	0	65.49
370	30.90	132.46	0	64.47
371	27.08	124.56	0	51.77
372	28.35	128.66	0	57.21
373	31.27	136.13	0	67.64
374	28.45	125.75	0	56.21
375	32.05	140.12	0	68.87
376	35.11	150.99	3	80.85
377	30.37	131.74	0	61.04
378	30.01	128.38	0	59.64
379	29.74	127.47	0	58.76
380	32.07	131.80	0	65.20
381	34.77	149.30	1	76.53
382	35.94	144.47	0	82.18
383	36.20	141.78	0	81.93
384	33.29	138.99	0	69.92
385	30.03	128.91	0	59.02
386	33.13	137.17	0	71.13
387	32.26	136.62	0	68.10
388	34.81	138.74	0	77.16
389	33.00	136.71	0	68.53
390	36.80	156.26	3	82.79

Appendix B

391	33.19	139.47	0	68.72
392	32.97	132.36	0	68.79
394	30.69	129.97	0	61.54
395	34.21	139.07	0	74.08
396	39.55	158.57	1	95.18
397	31.26	128.19	0	61.95
398	38.69	146.09	0	84.66
399	39.63	160.53	4	92.20
400	30.92	129.27	0	61.01
401	46.77	185.65	4	126.47
402	33.85	135.70	0	71.77
403	34.31	140.05	1	75.27
404	31.11	128.70	0	61.82
405	31.38	129.08	0	62.67
406	32.65	137.00	0	65.56
407	33.20	139.16	0	67.69
408	40.18	161.87	4	93.38
409	48.72	196.86	15	130.84
410	39.63	147.42	0	89.82
411	32.30	134.88	0	66.14
412	38.14	148.69	2	86.20
413	30.14	127.81	0	59.18
414	34.37	136.94	1	76.61
415	37.71	157.79	2	89.87
416	30.32	130.60	0	60.67
417	36.00	149.42	1	83.83
418	31.65	130.18	0	64.26
419	36.36	149.26	2	80.12
420	49.57	195.65	16	144.60
421	33.14	131.19	0	68.85
422	31.58	135.01	0	67.35
425	31.51	130.83	0	63.34
426	30.69	127.72	0	61.08

Appendix B

427	35.73	140.73	0	82.84
428	35.88	141.56	0	81.49
429	31.72	136.96	0	73.04
430	32.69	130.96	0	67.09
431	35.09	146.38	0	77.51
432	28.88	133.97	0	62.74
433	28.94	134.30	0	63.07
434	31.79	141.53	0	69.29
435	29.00	147.11	1	57.87
436	34.26	146.74	1	75.81
437	30.79	165.40	2	67.96
438	33.37	171.99	3	77.01
439	30.35	146.77	1	61.90
440	35.74	151.78	2	80.47
441	36.26	192.80	11	88.40
442	29.35	166.09	2	62.60
443	31.84	165.27	2	70.58
444	29.27	164.62	2	62.18
445	28.75	151.81	1	59.00
446	30.45	155.37	2	64.82
447	29.99	166.98	3	64.93
448	28.58	153.92	2	57.83
449	38.90	193.37	15	96.10
450	38.25	195.68	17	94.27
451	37.31	161.05	1	86.08
452	39.83	179.06	6	109.51
453	34.08	173.35	4	82.50
454	36.61	171.58	4	90.54
455	34.55	173.77	5	82.07
456	32.84	173.00	4	75.67
457	36.88	172.14	3	95.21
458	31.00	162.69	2	67.69
459	32.09	161.17	2	72.21

Appendix B

462	38.87	167.36	3	95.73
465	39.87	180.63	9	111.22
468	32.83	161.37	1	73.31
472	30.35	150.89	1	64.72
473	28.14	159.00	1	59.77
474	29.19	145.17	1	61.65
475	25.61	142.57	1	50.17
476	42.52	162.31	3	105.39
477	39.64	156.44	3	93.85
478	36.56	188.92	13	88.52
479	34.81	149.81	3	76.70
480	39.45	162.30	3	95.52
481	38.87	161.59	3	93.45
482	35.73	153.02	3	81.15
483	36.38	155.96	2	84.28
484	33.84	150.46	2	73.43
485	30.80	146.99	1	68.65
487	29.93	148.51	1	64.43
488	33.11	158.04	2	77.05
489	28.39	153.75	1	59.57
491	32.62	173.66	3	74.64
494	34.51	155.48	3	84.61
495	29.94	156.88	2	64.09
496	34.89	152.95	2	82.98
499	32.93	145.69	1	75.12
502	31.47	166.78	2	70.20
503	34.24	161.84	1	77.66
504	29.55	153.54	1	59.81
505	31.88	164.49	1	69.10
506	31.98	165.98	1	70.21
507	31.07	160.23	1	67.62
508	29.87	158.88	1	64.06
509	30.06	162.22	2	65.28

Appendix B

510	32.53	159.20	1	73.47
511	27.18	155.47	1	55.24
512	33.50	170.39	3	78.66
513	40.80	169.81	3	104.81
514	28.28	150.31	1	58.61
517	30.25	154.10	1	68.18
518	32.60	158.22	2	74.00
519	29.49	156.30	1	64.44
520	29.44	159.11	1	64.00
521	31.71	156.18	1	73.05
524	30.59	147.60	1	64.08
525	38.16	178.38	5	93.73
526	38.17	164.26	2	92.47
528	37.04	173.54	3	89.97
529	30.72	158.32	1	65.10
535	34.74	179.89	6	83.85
536	33.36	162.87	2	73.15
539	26.50	142.83	1	51.96
540	36.67	172.45	5	90.03
541	30.04	158.59	1	64.91
542	32.41	165.17	2	72.96
546	39.94	167.07	4	105.74
547	30.84	154.65	1	66.61
550	32.17	167.52	2	72.46
551	34.09	156.98	1	78.88
555	38.54	166.62	4	97.24
556	34.56	164.97	3	80.77
557	32.99	165.03	2	76.04
558	31.33	158.42	1	68.87
559	30.18	159.70	1	64.11
560	34.00	172.14	3	79.81
561	31.77	155.96	1	70.27
562	34.17	164.43	2	80.34

Appendix B

563	33.19	163.60	2	76.49
564	32.53	161.40	1	73.04
565	32.29	163.77	1	70.82
566	31.69	158.32	1	68.63
567	34.37	162.09	1	78.18
568	34.71	159.84	1	79.14
569	32.41	162.83	1	71.77
570	31.75	161.59	2	69.60
571	31.15	159.44	1	66.94
572	30.20	160.76	1	63.57
573	31.07	158.57	1	67.75
574	31.35	156.01	1	68.54
575	31.33	158.50	1	67.78
576	29.84	150.57	1	64.51
580	33.27	173.95	3	78.32
581	35.38	182.79	6	86.31
582	30.84	153.72	1	66.21
588	30.44	161.47	2	67.20
597	37.82	158.87	3	88.19
605	37.93	155.80	1	91.24
606	38.45	171.99	2	90.82
610	30.33	149.33	1	67.32
611	39.84	155.04	3	94.56
612	27.75	143.83	1	56.52
613	29.38	158.02	1	63.71
614	30.52	157.41	1	68.06
615	30.53	151.35	1	65.35
616	32.31	153.55	1	71.13
617	34.29	155.16	1	83.75
620	28.87	148.86	1	59.36
621	28.44	143.24	1	55.78
622	32.58	149.63	1	68.68
623	37.33	155.34	3	87.89

Appendix B

627	27.31	151.07	1	56.05
628	31.16	150.14	1	68.56
629	32.76	174.60	4	76.21
630	34.86	160.75	1	83.51
631	29.29	159.35	1	61.94
632	31.98	165.88	2	71.45
636	27.26	148.09	1	56.93
638	29.89	157.43	1	63.28
640	33.69	149.25	1	75.01
641	31.52	152.15	1	67.89
642	34.50	166.28	4	80.15
643	40.45	199.70	18	101.28
644	35.06	167.12	2	81.88
645	35.80	153.50	2	81.93
646	38.31	186.79	9	98.43
647	35.40	149.62	2	83.44
648	31.52	165.98	2	69.78
649	36.80	189.68	13	88.56
653	32.53	169.46	3	73.98
654	32.48	165.89	2	73.82
655	26.06	145.98	1	51.03
657	31.38	170.92	3	71.37
658	33.98	179.50	6	77.19
659	34.91	168.40	2	83.54
661	29.15	158.01	1	62.40
662	35.32	161.08	1	80.90
663	28.77	144.96	1	58.85
664	32.05	166.52	2	74.41
665	37.47	160.82	1	89.64
666	29.95	157.84	1	64.40
667	32.34	161.06	1	72.08
668	36.55	152.44	2	84.29
669	34.45	171.18	3	80.96

Appendix B

670	33.58	158.88	2	77.55
671	35.73	153.33	2	81.44
672	29.06	155.64	1	59.72
673	33.06	152.92	2	70.93
674	38.61	161.58	3	92.59
675	33.43	153.04	1	72.62
676	31.86	158.88	1	71.82
677	34.27	164.91	2	79.89
678	29.61	161.56	2	64.63
679	34.39	156.33	2	78.72
680	33.69	160.22	1	79.53
681	39.12	186.40	8	96.38
682	28.90	147.52	1	61.60
684	34.55	175.64	5	82.95
685	35.57	153.70	2	80.35
686	30.56	159.78	1	65.62
687	43.35	167.15	4	108.78
688	33.45	154.33	1	79.28
689	38.56	175.73	5	97.11
690	32.03	151.07	1	71.11
691	31.42	148.96	1	67.78
692	36.14	171.49	3	89.33
693	35.32	165.57	2	84.84
694	34.05	173.27	5	82.39
695	35.56	179.35	6	83.36
696	30.87	156.12	1	69.15
699	25.56	142.37	0	49.48
702	31.16	161.26	1	68.07
703	37.31	157.00	1	86.17
704	42.47	181.44	5	106.22
705	31.86	168.35	3	72.06
706	33.09	172.95	3	77.32
707	29.27	159.48	1	61.63

Appendix B

711	40.39	176.23	5	102.12
713	33.08	151.85	2	79.07
714	54.95	205.85	23	160.95
715	27.25	147.05	1	54.20
716	31.09	158.50	1	69.24
717	29.13	152.38	1	62.48
718	34.23	175.24	5	83.61
719	26.60	150.99	1	53.23
724	33.35	151.89	1	72.31
726	36.92	191.21	13	89.05
727	33.05	169.16	3	73.81
728	35.07	184.13	9	83.43
729	27.13	140.83	1	52.89
730	27.60	143.52	1	54.20
732	30.50	153.51	1	64.02
734	45.53	171.93	3	120.86
738	33.45	164.20	2	77.51
743	34.64	167.31	4	80.99
747	28.73	156.03	1	60.00
748	28.63	150.09	1	58.41
749	26.74	151.13	1	54.55
750	26.03	142.12	1	50.03
751	30.29	143.56	1	63.90
753	30.39	158.38	1	64.94
756	29.59	160.03	2	63.62
757	28.85	162.12	2	60.67
759	33.51	148.02	1	77.14
760	30.77	152.18	1	66.84
761	27.50	145.62	1	54.44
762	26.73	154.73	1	53.16
763	32.13	145.22	1	72.81
764	34.71	183.39	7	81.97
766	28.09	151.41	1	58.97

Appendix B

767	32.08	161.57	2	70.90
768	28.29	150.01	1	59.48
769	26.98	151.52	1	54.48
770	34.88	165.57	2	81.84
771	34.21	155.14	1	83.33
772	33.45	153.01	1	76.21
773	29.43	145.90	1	60.94
774	28.46	154.91	1	59.41
775	31.97	171.12	3	71.51
776	32.49	167.68	2	74.27
777	31.76	165.19	2	70.74
778	30.71	162.04	1	66.84
779	36.33	164.14	2	88.08
780	28.41	150.69	1	58.98
781	27.38	153.81	1	57.11
782	31.12	148.19	1	67.92
783	30.20	156.45	1	63.44
784	30.71	158.47	1	66.25
785	28.44	156.27	1	58.89
786	30.54	152.93	1	68.93
787	29.57	160.01	2	63.53
788	31.60	146.24	1	69.76
789	28.89	143.63	1	60.51
790	36.63	155.09	1	88.14
791	28.01	144.28	1	56.67
792	33.83	159.41	1	77.87
793	38.26	185.00	6	95.83
795	41.93	196.58	17	103.27
796	30.49	164.49	2	66.12
798	37.29	159.13	3	92.12
800	32.28	159.64	1	72.12
801	33.62	145.26	0	73.58
802	28.60	137.45	0	62.12

Appendix B

803	25.57	133.66	0	50.67
804	29.33	138.44	0	62.51
805	26.57	135.42	0	52.88
806	29.89	136.44	0	62.85
807	31.18	141.05	0	66.23
808	28.67	135.38	0	58.85
811	30.45	139.81	0	61.86
813	30.24	139.22	0	64.63
814	33.11	158.93	1	73.81
818	30.66	143.71	0	62.81
820	30.99	142.80	0	63.52
821	31.09	140.36	0	62.26
823	31.43	143.11	0	63.49
824	33.11	147.47	0	68.82
825	33.79	151.51	1	73.68
827	40.00	159.20	3	101.15
829	38.70	166.40	1	91.84
830	33.82	155.56	1	74.10
832	37.37	152.34	0	87.24
833	44.03	183.30	3	115.61
834	35.77	151.70	1	81.50
835	37.91	170.44	3	89.86
836	31.63	154.36	1	68.95
837	28.41	146.83	1	59.71
838	28.78	149.21	1	59.98
839	36.76	166.69	1	87.57
841	34.57	155.51	0	77.69
842	31.96	154.53	1	67.28
845	29.21	145.08	0	58.99
847	29.03	146.50	1	58.89
848	27.92	142.41	1	55.91
849	31.19	145.80	1	69.14
850	26.96	140.67	0	53.42

Appendix B

851	28.47	143.97	1	58.95
852	29.95	143.61	0	67.30
853	28.07	143.79	1	59.25
854	27.91	142.01	0	58.45
855	27.59	141.23	0	57.62
856	26.84	143.51	1	53.63
857	29.30	139.35	0	59.46
859	30.71	139.17	0	63.29
860	29.02	137.72	0	58.30
861	29.91	140.00	0	62.15
862	30.56	141.88	0	63.66
863	32.41	147.43	1	70.91
864	32.00	146.02	1	68.11
865	35.49	152.22	2	80.21
869	34.05	146.91	0	71.32
870	31.53	144.24	0	64.46
873	30.94	147.85	0	63.83
877	32.00	148.05	1	67.89
879	31.96	143.71	0	66.83
882	34.89	151.17	1	78.89
883	32.50	140.50	0	69.92
884	30.66	138.97	0	63.62
885	31.60	142.29	0	64.11
886	31.43	142.19	0	63.90
887	31.04	139.35	0	62.49
888	31.78	142.22	0	64.13
889	35.49	154.78	2	78.99
890	31.23	145.65	0	63.17
891	31.48	146.12	0	64.43
892	35.27	158.12	1	80.49
893	31.65	145.55	1	63.96
894	30.83	145.13	0	62.15
895	32.53	149.39	1	67.68

Appendix B

896	31.58	144.20	0	63.11
897	30.92	142.37	0	61.76
898	31.26	139.61	0	62.50
899	30.75	146.54	0	62.29
900	32.25	151.95	1	68.11
901	30.89	146.15	1	63.64
902	32.96	153.96	1	72.61
903	31.81	152.35	1	67.34
904	31.25	147.20	1	64.79
905	32.78	149.45	1	68.00
906	30.56	146.54	1	62.11
907	31.30	154.86	1	64.63
908	30.82	145.51	1	65.89
909	31.28	144.62	0	65.11
910	29.99	147.55	1	61.38
911	29.32	143.85	0	59.41
914	30.31	148.59	1	62.18
915	31.16	149.13	1	65.80
916	30.29	153.10	1	63.58
918	30.76	153.47	1	64.61
919	30.79	144.16	1	64.26
923	33.30	150.97	1	71.24
924	31.72	152.92	1	68.36
925	30.53	158.72	1	64.47
926	30.22	152.68	1	63.61
927	28.13	146.72	1	56.16
928	29.38	150.04	1	60.52
929	28.07	145.71	1	57.21
930	27.74	146.64	1	55.88
931	28.52	144.74	1	59.88
932	28.38	148.85	1	58.22
933	28.40	144.71	1	57.64
934	30.53	151.04	1	65.47

Appendix B

935	29.71	148.43	1	64.15
936	29.51	156.36	1	62.57
937	28.02	151.15	1	56.80
938	30.98	165.88	2	67.46
939	31.81	167.20	2	70.13
940	31.21	150.68	1	67.10
941	34.33	159.63	1	79.54
942	27.78	150.86	1	55.53
943	32.84	159.82	1	75.67
944	30.23	158.18	1	62.36
945	31.48	161.38	2	66.66
946	29.62	155.41	1	64.40
947	29.87	158.55	1	65.88
948	29.75	159.59	1	61.05
949	29.72	142.49	1	60.04
950	28.98	159.43	1	63.11
951	31.26	151.98	1	69.44
952	30.05	146.54	1	63.48
953	28.71	153.42	1	59.10
954	29.43	155.30	1	61.77
955	31.13	166.56	2	68.90
956	31.02	160.57	1	67.78
957	29.75	159.38	2	65.53
958	29.09	146.18	1	61.45
959	29.42	147.59	1	62.24
960	29.35	157.74	1	62.31
961	28.35	146.73	1	58.53
962	28.18	149.49	1	58.30
963	26.46	131.68	0	51.78
964	25.83	131.76	0	50.79
965	26.32	135.74	0	52.09
966	25.30	140.03	0	49.88
967	24.74	135.89	0	47.93

Appendix B

968	24.94	141.05	0	48.27
969	26.41	145.18	1	51.46
970	26.54	140.45	0	52.07
971	27.15	141.69	1	52.94
972	31.46	144.99	1	65.38
973	32.39	147.67	1	66.47
974	30.54	138.07	0	61.41
975	28.85	136.74	0	56.98
976	28.07	136.56	0	55.20
977	28.32	144.32	0	56.79
979	35.48	148.65	1	82.67
980	30.97	141.60	0	64.01
981	30.14	138.25	0	60.83
982	35.10	160.72	1	82.00
983	31.56	146.42	1	68.49
984	27.41	135.11	0	54.22
985	32.44	147.37	1	72.52
986	29.94	143.85	0	62.41
987	26.37	140.32	0	51.39
988	31.60	150.92	1	68.86
989	30.58	160.61	2	65.43
990	45.28	209.02	28	118.31
991	29.42	143.95	0	59.66
992	29.81	146.46	0	61.73
993	32.78	147.56	1	70.83
994	34.06	150.39	1	73.77
995	33.82	145.45	0	73.50
996	24.85	136.17	0	48.23
997	31.63	153.70	1	67.75
998	31.26	146.86	0	64.97
999	36.93	163.87	1	85.04
1000	43.83	193.36	13	111.59
1001	37.14	165.56	2	87.52

Appendix B

1002	32.60	148.15	1	68.27
1003	35.31	154.24	1	76.73
1004	33.05	145.75	0	68.54
1005	37.38	176.23	3	89.94
1006	27.69	142.90	1	55.65
1007	30.04	143.30	1	60.05
1008	35.58	155.13	1	79.11
1009	34.99	148.18	0	74.77
1010	39.11	152.19	2	107.42
1011	34.02	139.46	1	73.68
1012	30.32	137.61	1	59.64
1013	29.35	138.97	1	57.79
1014	30.28	143.64	1	62.29
1015	34.38	143.61	1	73.05
1016	28.55	139.01	1	56.07
1017	29.28	141.07	1	58.45
1018	37.09	142.69	2	82.19
1019	39.18	149.14	2	88.82
1020	35.04	153.70	2	74.89
1021	41.90	178.71	6	98.99
1022	35.83	142.34	1	77.71
1023	36.04	145.89	1	77.42
1024	39.00	153.50	1	88.70
1025	33.71	138.44	1	70.38
1026	39.23	146.42	2	89.11
1027	32.09	141.86	1	66.51
1028	36.12	148.57	1	81.22
1029	38.63	141.92	1	88.98
1030	29.16	139.69	1	58.09
1031	29.15	132.26	1	57.06
1032	34.81	140.11	1	75.05
1033	41.52	167.08	4	102.61
1034	38.15	161.16	3	90.32

Appendix B

1035	30.97	133.26	1	61.92
1036	38.44	147.77	2	92.24
1037	33.87	144.01	1	70.91
1038	33.03	140.16	1	70.29
1039	32.76	139.33	1	70.54
1040	29.94	146.56	1	64.38
1041	28.26	144.72	1	59.33
1042	32.19	143.41	1	68.82
1043	41.45	157.98	4	105.30
1044	51.58	196.06	15	144.79
1045	35.41	153.82	3	76.45
1046	38.62	144.82	1	88.18
1047	38.47	167.41	3	90.65
1048	63.00	247.71	134	192.81
1049	34.30	138.61	1	75.88
1050	29.99	142.38	1	65.65
1051	29.32	131.97	1	63.35
1052	29.17	134.97	1	61.18
1053	28.35	129.84	1	58.25
1054	38.03	155.49	2	93.12
1056	37.62	145.85	1	85.41
1057	35.88	148.91	2	79.19
1058	33.24	145.38	1	73.72
1059	33.64	141.34	1	71.09
1060	35.41	147.75	2	77.13
1061	29.18	131.66	1	57.62
1062	35.97	172.88	7	87.53
1063	36.48	144.41	2	78.91
1064	28.13	139.11	1	57.53
1065	30.36	144.09	1	65.06
1066	32.55	137.43	1	67.26
1067	31.07	135.11	1	62.73
1069	35.13	148.03	1	89.54

Appendix B

1070	31.08	138.70	1	62.73
1071	41.12	149.19	2	96.45
1072	40.12	154.65	2	92.34
1073	39.95	147.33	1	91.80
1074	37.29	151.63	2	82.75
1075	28.22	129.87	1	54.85
1076	39.31	154.27	2	101.77
1077	28.62	131.04	1	60.16
1078	31.77	134.53	1	63.99
1079	33.39	134.35	1	70.66
1080	35.17	138.71	1	73.88
1081	34.56	151.06	2	73.45
1082	31.12	129.12	1	61.88
1083	30.78	132.43	1	61.24
1084	29.88	127.40	1	58.18
1085	37.37	144.04	1	86.15
1086	30.61	130.47	1	60.00
1087	27.89	139.07	1	54.23
1088	33.00	134.30	1	68.41
1089	26.42	128.66	1	51.24
1091	29.38	138.46	1	56.83
1092	36.68	174.93	7	91.76
1093	32.14	140.09	1	70.14
1094	25.76	135.27	1	49.28
1095	26.76	134.30	1	51.06
1096	38.74	187.27	9	100.64
1097	37.51	160.47	2	85.77
1098	27.66	137.95	1	53.36
1099	28.00	135.43	1	54.86
1100	37.04	170.34	4	86.50
1101	35.09	153.63	3	77.24
1102	35.63	147.30	1	75.82
1103	49.72	185.98	9	148.85

Appendix B

1104	39.36	167.95	3	96.90
1105	42.82	170.51	4	104.28
1106	31.22	137.48	1	62.73
1107	27.76	134.95	1	53.47
1108	29.47	139.84	1	57.46
1109	27.05	128.73	1	51.34
1110	26.37	127.67	1	50.55
1111	27.64	139.47	1	53.69
1112	29.57	136.27	1	57.78
1113	29.73	135.38	1	58.60
1114	29.41	136.90	1	58.81
1115	36.54	145.95	1	83.61
1118	27.47	132.84	1	55.31
1119	29.72	136.23	1	58.17
1120	34.44	145.07	1	78.38
1437	34.18	154.06	2	74.43
1438	31.89	144.33	1	64.18
1439	42.00	173.35	3	101.00
1440	35.94	153.41	2	78.37
1441	39.18	173.75	4	90.78
1442	37.14	149.75	2	81.08
1443	35.34	162.12	2	76.07
1444	33.70	152.32	1	73.85
1445	33.81	163.67	4	72.32
1446	33.88	150.01	2	71.53
1447	27.53	150.32	1	54.44
1448	25.84	149.26	0	50.38
1449	28.15	152.20	1	55.86
1450	30.94	154.56	1	65.99
1451	29.86	152.89	1	61.97
1452	34.05	159.50	1	77.85
1453	33.07	149.61	1	73.50
1454	29.24	146.49	1	58.73

Appendix B

1455	30.58	140.25	0	62.84
1456	38.40	173.44	3	94.94
1457	34.56	167.29	4	78.18
1458	33.89	153.04	2	71.42
1459	31.59	146.93	1	64.21
1460	39.63	158.91	2	91.91
1461	44.16	197.00	17	111.75
1462	46.76	185.62	7	118.18
1463	48.95	219.15	40	132.68
1464	38.76	161.52	3	88.09
1465	31.98	162.16	2	68.54
1466	31.97	155.41	1	68.49
1467	28.80	146.63	0	59.29
1468	29.84	149.65	0	64.37
1469	32.58	154.58	2	70.28
1470	30.22	146.80	1	61.69
1471	27.86	148.43	0	56.67
1472	25.96	143.79	0	50.70
1473	27.39	146.39	0	55.26
1474	32.96	149.32	2	72.59
1475	33.68	159.38	2	76.06
1476	35.26	152.55	2	77.89
1477	23.83	144.00	0	45.69
1478	27.40	144.74	0	54.23
1479	30.51	148.85	1	62.48
1480	32.34	146.70	1	65.12
1481	39.09	165.47	3	89.41
1482	38.60	153.72	2	87.74
1483	35.59	169.60	4	77.56
1484	38.70	172.41	4	89.02
1485	30.25	147.67	2	62.83
1486	32.37	158.26	2	70.24
1487	31.50	146.69	1	63.87

Appendix B

1488	44.53	177.60	5	112.16
1489	32.68	150.33	2	66.94
1490	37.84	169.88	3	92.69
1491	30.23	138.56	0	63.43
1492	29.87	140.19	0	62.44
1493	32.09	145.48	1	68.88
1494	36.96	171.65	2	87.02
1495	36.39	154.68	2	83.12
1496	37.37	157.63	3	89.52
1497	33.15	139.21	0	69.96
1498	32.40	137.91	0	68.66
1499	33.74	144.80	1	76.32
1500	33.68	143.10	0	72.71
1501	37.41	157.20	2	85.51
1502	44.02	190.54	6	109.41
1503	38.98	157.79	1	93.86
1504	38.77	167.10	2	92.87
1505	29.72	131.33	0	59.15
1506	29.45	130.22	0	59.16
1507	32.23	145.44	1	69.87
1508	33.50	149.42	1	74.52
1509	40.45	157.57	1	100.50
1510	31.56	138.50	0	65.56
1511	36.51	144.49	1	82.46
1512	34.07	143.62	1	74.58
1513	33.34	143.93	1	72.07
1514	38.91	154.76	0	90.07
1515	33.90	152.64	1	75.71
1516	29.77	135.42	0	60.70
1517	29.33	135.01	0	58.65
1518	30.87	138.08	0	64.50
1519	31.56	139.01	0	65.15
1520	30.25	133.29	0	60.20

Appendix B

1521	32.52	146.54	1	71.07
1522	31.09	140.96	1	64.41
1523	35.06	147.24	1	78.04
1524	33.65	148.65	1	76.07
1525	34.09	144.52	0	76.91
1526	32.63	148.58	1	71.48
1527	29.40	136.06	0	59.74
1528	28.78	136.17	0	58.12
1529	32.25	138.83	0	66.27
1530	30.42	139.07	0	63.65
1531	29.43	137.13	0	61.42
1532	29.14	135.36	0	59.02
1533	28.68	134.85	0	58.90
1534	29.63	136.08	0	62.65
1535	33.36	142.34	0	78.28
1536	30.52	136.80	0	68.60
1537	32.03	139.36	0	70.40
1538	32.47	141.23	0	70.74
1538	32.41	141.23	0	70.57
1539	33.18	136.79	0	74.80
1539	33.14	137.20	0	74.68
1540	34.52	150.95	1	80.12
1540	34.48	150.99	1	80.00
1541	30.67	137.33	0	63.76
1541	30.61	138.76	0	63.61
1542	30.61	135.80	0	63.05
1543	30.94	135.02	0	63.28
1544	34.43	149.14	1	77.56
1545	26.73	128.98	0	53.83
1546	27.85	130.15	0	56.11
1547	31.87	143.22	0	69.89
1548	37.43	153.30	0	97.89
1549	30.06	142.66	0	65.39

Appendix B

1550	28.31	138.74	0	59.35
1551	30.18	145.83	0	65.44
1551	30.25	145.46	0	65.64
1552	29.74	135.85	0	63.35
1553	27.70	134.88	0	58.08
1554	29.42	134.27	0	61.80
1555	27.88	134.21	0	57.38
1556	31.30	145.64	1	67.05
1557	29.57	139.65	0	61.05
1558	28.82	139.08	0	59.01
1559	33.47	146.27	0	73.82
1560	31.41	140.87	0	67.19
1561	30.38	140.77	0	62.55
1562	31.90	140.47	0	68.43
1563	31.51	143.88	0	65.22
1564	33.44	144.73	1	71.69
1565	34.99	151.32	1	77.32
1566	35.35	148.41	1	79.34
1567	34.48	146.57	1	76.75
1568	32.93	139.86	0	68.05
1569	37.05	145.66	0	84.19
1570	38.80	148.53	1	88.20
1571	31.96	137.81	0	64.60
1572	46.56	178.15	4	116.71
1573	46.73	184.77	5	118.59
1574	35.92	145.38	0	75.32
1575	52.02	202.22	22	138.00
1576	47.53	180.04	4	115.43
1577	37.85	153.28	1	84.46
1578	32.53	138.71	1	66.64
1579	34.95	146.21	1	74.77
1580	39.81	149.07	2	92.25
1581	33.65	145.58	1	71.77

Appendix B

1582	35.71	141.21	0	78.72
1583	33.67	145.62	0	71.38
1584	34.19	140.38	0	75.09
1585	47.13	190.44	11	121.20
1586	33.35	137.42	0	66.93
1587	32.56	137.63	0	65.00
1588	42.11	156.89	2	98.24
1589	32.59	137.76	0	64.86
1590	33.27	143.07	1	69.00
1591	35.17	148.98	1	78.35
1592	32.85	143.01	0	67.99
1593	32.21	130.62	0	63.46
1594	31.95	134.54	0	64.77
1595	39.46	148.22	1	88.56
1596	36.70	154.51	3	80.56
1597	31.69	132.79	0	62.38
1598	33.05	149.38	1	71.67
1599	31.77	138.63	0	66.89
1600	32.05	136.08	0	66.36
1601	26.82	126.76	0	52.14
1602	30.13	133.23	0	62.81
1603	36.30	152.02	2	85.02
1604	31.76	142.35	1	66.38
1605	32.20	134.56	1	64.93
1606	25.05	122.77	0	47.07
1607	28.84	126.98	1	55.08
1608	30.88	131.02	1	60.53
1609	36.28	148.06	0	95.68
1610	55.59	205.12	28	162.48
1611	40.47	151.76	1	96.09
1612	35.15	147.88	2	78.12
1613	40.22	150.38	2	94.95
1614	37.20	143.33	2	85.94

Appendix B

1615	45.03	180.96	7	114.36
1616	46.67	183.22	7	123.74
1617	38.01	171.99	5	91.88
1618	41.50	176.34	4	112.27
1619	31.80	132.73	0	63.26
1620	32.87	134.17	1	66.54
1621	42.33	154.35	1	110.92
1622	35.46	149.75	2	76.13
1623	38.19	153.77	2	94.01
1624	27.48	125.16	0	52.33
1625	36.35	163.77	3	86.17
1626	29.29	131.46	0	60.61
1627	31.20	143.37	1	69.81
1628	26.12	123.28	0	49.21
1629	26.11	123.20	0	49.14
1630	25.46	122.86	0	47.99
1631	26.31	127.35	0	49.95
1632	25.80	123.58	0	48.97
1633	25.25	123.12	0	48.01
1634	25.54	126.75	0	48.05
1636	26.06	123.83	0	49.36
1637	25.32	122.60	0	47.42
1638	28.90	132.61	0	58.54
1639	26.44	125.03	0	50.16
1640	26.11	123.28	0	49.53
1642	26.87	124.78	0	51.74
1644	26.43	124.02	0	51.37
1645	28.08	126.53	0	54.36
1648	27.55	125.45	0	52.45
1649	27.03	124.47	0	51.23
1650	27.14	127.17	0	51.81
1651	28.30	126.94	0	54.22
1652	27.17	125.15	0	51.44

Appendix B

1653	27.36	125.15	0	51.99
1654	28.54	128.19	1	55.42
1655	27.93	129.45	1	53.60
1656	27.36	125.77	1	52.54
1657	26.84	125.95	1	51.32
1658	27.98	127.15	1	53.96
1659	26.82	125.12	1	51.44
1660	31.96	140.98	1	65.93
1661	28.73	127.32	1	55.62
1662	29.43	127.81	1	57.48
1663	28.49	125.75	1	54.83
1664	28.87	127.26	0	55.78
1665	29.25	126.48	1	56.76
1666	29.65	130.38	1	58.29
1667	28.78	127.72	1	55.68
1668	29.31	130.09	1	57.21
1669	29.37	128.72	1	57.35
1671	28.07	124.78	0	53.82
1672	31.69	131.72	0	64.16
1673	28.50	126.70	0	55.51
1674	31.00	129.47	0	61.91
1675	31.20	129.39	0	62.15
1676	32.17	134.20	1	64.46
1677	29.51	127.00	0	57.42
1678	28.81	125.78	0	55.44
1680	30.67	129.14	0	60.70
1681	31.89	133.52	0	65.88
1682	32.55	131.81	1	64.73
1683	31.18	131.54	1	61.39
1684	31.96	133.23	0	64.76
1685	30.37	129.06	1	59.59
1686	31.56	129.62	1	62.58
1687	36.28	141.84	1	80.64

Appendix B

1688	29.27	129.44	1	56.47
1689	28.52	126.70	1	55.00
1690	31.18	129.53	1	61.82
1691	31.02	131.22	1	60.74
1692	37.92	150.32	1	86.17
1693	32.23	137.26	1	65.04
1694	30.74	129.96	1	59.72
1695	30.10	129.64	1	58.53
1696	34.86	137.53	1	74.83
1697	33.44	139.42	1	67.37
1698	30.73	129.48	0	61.13
1699	31.24	130.94	0	62.01
1700	30.84	131.04	0	61.19
1701	29.91	129.02	0	58.52
1702	31.26	130.44	0	62.30
1703	29.94	131.98	1	58.29
1704	30.51	135.04	1	59.64
1705	36.59	141.80	1	83.15
1706	31.87	132.25	0	64.73
1708	31.35	130.09	0	62.90
1709	31.34	130.46	0	62.90
1710	33.60	133.41	0	70.85
1711	26.63	124.88	0	50.30
1712	29.39	128.22	1	57.32
1713	29.74	129.17	1	57.73
1714	29.49	128.10	1	56.85
1715	30.76	130.59	1	60.14
1716	30.30	130.45	0	60.23
1717	31.78	130.43	0	63.23
1718	28.90	128.04	1	55.62
1719	28.91	126.88	0	57.64
1720	26.14	125.86	0	49.56
1721	29.91	128.46	0	59.74

Appendix B

1722	47.06	212.66	33	146.46
1723	29.15	126.50	0	56.28
1724	32.10	134.14	0	64.42
1725	33.06	139.56	1	70.83
1726	41.94	155.86	2	102.52
1727	36.69	161.74	1	81.17
1728	49.28	209.57	33	131.52
1729	33.15	149.35	1	68.12
1730	36.14	149.13	2	78.96
1731	34.53	153.66	2	73.97
1732	36.24	157.95	1	78.01
1733	31.60	148.37	1	63.08
1734	36.98	160.15	2	81.32
1735	33.86	156.14	2	71.02
1736	33.96	164.38	1	81.40
1737	33.64	143.87	0	68.81
1738	35.46	147.15	1	74.85
1739	36.64	147.74	1	78.12
1740	38.59	165.75	4	85.93
1741	38.23	153.98	1	86.08
1742	34.37	142.65	1	71.18
1743	36.93	150.47	1	80.24
1744	36.14	145.40	1	76.99
1745	33.76	137.59	0	71.40
1746	36.98	153.20	1	80.38
1747	38.27	151.16	2	85.79
1748	33.43	147.09	2	68.41
1749	44.11	161.20	1	112.36
1750	35.41	144.84	1	76.33
1751	36.14	145.87	1	82.72
1752	31.61	135.45	0	63.89
1753	35.12	158.60	1	80.69
1754	34.47	150.31	1	76.79

Appendix B

1755	32.42	147.46	1	68.63
1756	35.88	157.31	1	83.15
1757	32.00	153.01	1	68.94
1758	34.03	149.89	1	74.02
1759	28.95	153.06	1	58.59
1760	33.84	143.52	0	70.03
1761	36.62	164.28	2	81.49
1762	33.72	164.23	3	78.12
1763	51.85	178.20	6	138.03
1764	31.67	155.92	1	67.08
1765	36.04	164.39	2	79.55
1766	37.01	177.00	5	88.49
1767	34.91	161.41	3	77.61
1768	34.67	157.12	3	79.39
1769	33.80	163.40	2	76.32
1770	37.47	180.99	6	89.42
1771	35.53	169.87	2	80.83
1772	43.74	210.10	28	113.37
1773	39.80	156.47	4	90.82
1774	44.53	193.39	15	115.33
1775	45.57	219.47	46	121.08
1776	41.20	200.36	20	103.24
1777	47.49	175.88	6	121.77
1778	45.69	216.96	33	119.74
1779	36.02	157.24	2	78.70
1780	38.19	158.58	2	89.46
1781	28.97	156.04	1	60.14
1782	26.68	149.59	0	52.12
1783	26.68	149.66	0	52.18
1784	28.33	152.32	1	55.53
1785	28.09	148.89	1	55.28
1786	26.93	150.60	0	52.65
1787	26.99	151.16	0	52.74

Appendix B

1788	26.92	151.63	0	52.60
1789	44.41	172.22	4	111.43
1790	37.65	162.41	3	82.99
1791	46.91	182.98	9	123.15
1792	36.34	156.49	1	78.52
1793	36.78	151.63	2	79.38
1794	37.94	151.80	2	83.88
1795	40.35	155.09	3	93.22
1796	37.38	182.92	6	85.73
1797	51.18	213.39	37	139.37
1798	45.18	172.19	6	110.28
1799	42.75	182.99	6	104.17
1800	38.19	150.01	2	82.99
1801	38.01	162.13	2	86.61
1802	41.07	157.33	4	93.88
1803	56.47	196.63	16	158.04
1804	57.58	203.06	24	162.57
1805	38.46	161.51	2	88.44
1806	41.22	158.47	3	96.46
1807	38.78	163.81	4	87.99
1808	39.70	148.04	0	91.24
1809	41.42	172.80	5	98.64
1810	33.30	138.17	0	69.57
1811	33.30	151.43	2	66.68
1812	33.89	152.51	2	68.57
1813	49.36	209.91	33	131.86
1814	51.23	174.33	3	138.06
1815	33.54	142.92	1	75.58
1816	32.74	141.21	1	70.95
1817	31.70	139.46	1	66.40
1818	32.91	141.49	1	73.49
1819	32.53	140.53	1	71.26
1820	29.17	139.48	1	58.14

Appendix B

1821	30.12	137.64	1	62.11
1822	27.41	138.93	1	58.47
1823	30.10	138.04	1	66.16
1824	28.23	140.10	1	54.83
1825	32.99	143.24	1	72.55
1826	32.81	141.85	1	72.23
1827	33.10	142.91	1	73.40
2001	31.50	148.75	1	65.30
2002	54.68	207.72	28	150.92
2003	24.91	149.30	1	48.47
2004	40.81	143.83	1	96.85
2005	28.22	140.08	1	54.81
2006	39.56	146.77	2	89.31
2007	32.68	130.93	0	67.06
2008	36.27	158.65	2	78.26
2009	47.46	200.83	20	123.87
2010	36.16	169.95	4	88.81
2011	36.56	145.96	1	83.70
2012	28.20	127.23	1	53.91
2013	31.61	146.97	1	64.27
2014	40.27	159.33	2	94.31
2015	27.89	148.09	1	56.13
2016	30.48	153.42	1	63.97
2017	36.26	158.56	2	78.21
2018	47.91	203.50	22	125.74
2019	26.86	127.06	0	53.51
2020	39.45	146.36	2	88.85
2022	43.00	146.60	2	108.34
2023	49.52	174.23	4	134.55
2024	32.25	132.35	0	64.31
2025	31.23	129.38	0	61.68
2026	30.36	134.01	1	60.19
2027	33.02	147.96	1	69.21

Appendix B

2028	24.67	132.89	1	46.60
2029	39.12	143.14	1	89.30
2030	49.73	200.33	20	136.69
2031	34.03	143.29	1	71.01
2032	40.59	162.25	3	103.27
2033	42.07	157.21	1	107.08
2034	50.33	173.00	5	138.52
2035	61.81	219.82	36	224.19
2036	29.94	140.96	1	62.35
2037	30.64	143.31	1	64.60
2038	42.15	191.39	11	105.40
2039	33.87	148.45	1	71.84
2040	31.37	139.80	1	64.11
2041	40.19	147.30	2	92.46
2042	32.50	133.33	1	66.33
2042	31.82	133.90	1	64.50
2043	30.49	138.48	1	63.35
2044	38.14	159.01	1	85.44
2045	30.73	130.12	1	60.32
2046	31.29	137.40	1	63.00
2046	31.37	140.31	1	63.21
2047	29.92	135.44	1	59.41
2048	27.76	138.88	1	53.91
2049	25.64	125.58	1	48.59
2050	29.71	138.67	1	57.69
2051	25.95	135.26	1	49.81
2052	26.90	134.40	1	51.44
2053	27.63	137.95	1	53.27
2054	27.04	135.39	1	52.10
2055	28.08	138.57	1	54.93
2056	29.74	136.23	1	58.23
2058	28.19	152.50	0	56.54
2059	27.30	152.37	1	53.47

Appendix B

2060	33.51	148.41	1	70.46
2061	35.28	158.50	1	76.15
2062	32.14	140.43	0	64.34
2063	36.58	143.37	0	82.53
2064	28.78	142.85	1	57.61
2065	32.20	136.10	0	66.23
2066	37.52	161.81	3	82.50
2067	37.19	159.28	2	84.17
2068	39.85	153.46	1	92.20
2069	37.32	149.82	1	82.33
2070	36.54	156.00	2	84.80
2071	51.90	182.14	6	138.35
2072	31.48	160.51	1	68.04
2073	47.80	176.63	6	123.05
2074	38.85	158.60	1	87.09
2075	43.03	164.00	2	103.11
2076	36.74	146.03	1	80.99
2077	35.67	147.93	1	75.71
2078	37.94	167.24	3	95.96
2079	32.44	168.83	3	74.72
2080	33.41	163.32	2	77.42
2081	32.87	160.72	1	75.45
2082	32.45	160.54	1	71.17
2083	28.78	150.93	1	58.89
2084	33.20	162.50	2	74.39
2085	30.71	154.68	1	64.38
2086	40.70	159.10	3	100.29
2087	34.59	170.74	3	83.17
2088	53.22	212.99	31	152.02
2089	32.15	149.31	1	71.17
2090	33.70	157.00	3	73.58
2091	29.11	151.91	1	58.90
2092	39.46	166.35	4	96.25

Appendix B

2093	30.29	157.23	1	66.44
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Table B5 Predicted Total NO₂ concentrations at Receptor Points 2016

Receptor Number	NO ₂ average(µg/m ³)	NO ₂ hourly 99.79 percentile value	NO ₂ number of exceedances	NO _x average(µg/m ³)
1	50.08	194.70	16	160.27
3	44.52	170.23	5	117.90
4	30.47	132.41	0	60.00
5	27.68	140.03	1	52.90
6	27.69	140.12	1	53.22
7	33.10	140.19	1	65.95
8	33.98	137.54	1	71.08
9	31.77	140.97	1	65.54
10	33.66	137.24	1	67.90
11	29.93	138.17	1	57.50
12	34.87	146.14	2	72.20
13	33.82	146.79	1	68.56
14	32.57	135.89	1	64.77
15	31.91	145.25	1	63.38
16	31.98	137.86	1	62.66
17	33.66	134.53	0	67.30
18	29.87	139.34	1	57.37
19	41.39	149.41	2	104.20
20	41.40	154.59	2	103.33
21	33.55	139.91	1	71.58
23	31.78	145.55	1	63.58
24	32.80	148.37	2	65.66
25	38.77	144.66	1	87.64
26	33.41	151.42	2	71.21
27	37.27	140.77	0	81.01
28	35.94	138.67	0	75.90
29	37.16	159.10	3	82.82
30	28.99	135.29	1	61.01

Appendix B

31	29.46	136.61	1	57.79
32	31.44	139.10	1	60.89
33	30.72	140.38	1	57.97
34	33.36	146.59	1	66.30
35	37.24	152.08	2	80.39
36	32.19	143.19	1	62.87
37	33.78	146.38	1	67.20
38	29.22	130.56	0	56.02
39	29.08	131.69	0	55.65
40	29.93	128.75	0	56.73
41	30.10	133.90	1	57.29
42	27.86	138.53	1	53.12
43	29.06	135.28	1	55.97
44	35.58	143.02	1	74.58
45	31.39	140.83	1	62.32
46	32.93	134.94	0	67.23
47	32.95	131.88	0	64.49
48	28.82	130.13	0	54.50
49	31.88	144.01	1	63.02
51	32.20	136.45	1	63.50
52	31.63	140.21	1	62.96
53	30.19	131.83	0	57.72
54	30.47	131.44	0	59.44
55	30.42	133.93	1	59.94
56	31.72	142.22	1	62.32
57	28.91	131.23	1	54.77
58	28.79	136.85	1	55.29
59	30.39	131.09	0	58.89
60	28.45	134.67	1	53.70
61	30.90	133.02	0	60.19
62	34.78	136.05	0	72.47
64	30.35	134.00	0	58.88
65	30.36	134.01	0	58.93
66	29.99	137.72	1	57.58
67	35.68	141.82	1	75.21

Appendix B

68	29.36	132.16	0	56.23
69	30.79	134.63	0	60.29
70	30.75	133.58	0	60.84
71	29.83	130.97	0	57.03
72	29.01	138.88	1	55.56
74	29.23	138.80	1	54.85
75	29.73	131.03	0	56.58
76	31.49	131.15	0	60.92
77	29.78	140.53	1	57.30
78	31.09	142.30	1	61.02
79	27.13	134.79	1	50.47
80	29.42	129.81	0	56.57
81	31.87	136.63	1	62.04
82	28.30	141.54	1	53.55
83	30.70	129.59	0	59.03
84	28.36	142.23	1	54.45
86	27.27	143.23	1	51.70
87	30.09	128.30	0	57.69
88	30.80	135.77	1	60.12
89	28.45	141.94	1	53.83
90	36.69	160.02	3	78.55
91	30.25	132.58	0	58.41
92	28.32	135.01	1	53.73
93	29.71	134.25	1	57.24
94	32.92	136.59	0	65.80
95	31.80	136.88	1	61.58
96	29.35	130.14	0	56.01
97	30.07	129.77	0	57.22
98	29.88	131.92	0	57.09
99	31.10	133.75	0	61.15
100	27.38	133.48	1	51.09
101	31.38	130.82	0	61.66
102	28.83	131.47	0	54.45
103	28.16	134.71	1	53.08
104	31.94	141.83	1	62.82

Appendix B

105	29.30	139.08	1	55.94
106	31.63	138.11	1	61.67
107	30.15	136.95	1	57.54
108	32.27	136.11	1	63.19
109	31.28	135.31	0	60.11
110	30.12	139.97	1	58.01
111	31.03	140.82	1	60.37
112	30.04	132.79	0	58.07
113	33.51	134.67	0	66.81
114	31.18	134.31	1	62.13
115	29.42	137.98	1	56.72
116	37.42	147.49	2	80.02
117	32.85	138.67	0	66.75
118	29.17	127.13	0	55.15
119	28.78	138.54	1	53.98
120	33.95	144.26	1	69.39
121	34.07	134.41	1	74.32
122	31.56	129.95	0	65.11
123	29.30	130.72	0	55.71
124	32.50	139.68	1	64.57
125	30.46	137.82	1	58.57
126	28.83	135.13	1	55.27
127	28.18	135.16	1	53.27
128	34.49	136.57	0	69.35
129	30.78	132.02	0	59.46
130	34.56	135.77	0	70.92
131	30.55	129.58	0	59.02
132	34.47	135.41	1	71.28
133	29.09	131.77	0	54.82
134	28.07	142.02	1	53.43
135	28.30	138.21	1	53.25
136	29.44	133.62	1	56.21
137	29.35	137.49	1	55.37
138	31.02	133.07	1	60.70
139	34.34	137.79	1	70.91

Appendix B

140	30.18	133.15	0	58.02
141	30.13	130.01	0	57.74
142	29.16	133.99	1	54.77
143	28.40	138.46	1	53.75
144	27.85	141.93	1	52.84
145	30.63	138.25	1	60.21
146	30.28	131.20	1	58.21
147	28.72	131.22	0	54.07
148	33.75	137.97	0	68.58
149	33.60	143.36	1	69.34
150	29.25	141.09	1	55.96
151	30.17	140.32	1	58.38
152	29.53	129.42	0	56.21
153	31.34	136.80	1	61.36
154	29.89	128.30	0	56.73
155	28.69	129.38	0	54.28
156	30.09	130.11	0	57.81
157	27.99	136.06	1	52.67
158	29.17	131.27	0	55.06
159	31.01	132.43	1	60.10
160	30.09	137.67	1	57.74
161	28.34	141.91	1	53.73
162	31.70	134.12	0	63.25
163	29.82	127.10	0	57.07
164	33.12	142.05	0	66.77
165	29.97	141.95	1	57.66
166	29.76	129.94	0	56.06
167	30.17	130.78	0	57.66
168	29.02	133.63	1	55.16
169	32.03	137.23	1	63.10
170	34.07	144.36	1	73.29
171	29.59	137.89	1	56.52
172	28.76	130.93	0	54.35
173	29.61	139.08	1	56.00
174	30.06	129.98	1	57.82

Appendix B

175	30.97	136.46	1	59.63
176	29.29	134.15	1	56.97
177	29.10	139.68	1	54.78
178	30.61	141.99	1	60.64
179	27.81	137.90	1	53.06
180	34.62	146.57	1	83.19
182	29.85	135.13	1	57.60
183	31.27	143.37	1	62.74
186	28.75	130.46	0	54.32
187	36.14	136.54	0	76.59
188	29.90	135.14	1	57.78
189	28.79	131.23	0	54.25
190	28.95	129.17	0	54.48
191	29.34	130.69	0	56.22
192	29.51	138.84	1	56.88
193	30.02	137.12	1	57.62
194	29.19	129.72	1	55.06
195	30.22	132.38	0	58.17
197	28.20	137.83	1	54.26
198	28.75	130.46	0	54.32
199	29.00	128.35	0	54.36
200	29.99	139.48	1	57.84
201	31.86	146.71	1	62.23
202	30.55	136.14	1	60.03
203	29.77	129.76	0	57.04
204	29.40	134.95	1	55.89
205	34.13	141.55	1	69.99
206	30.55	130.17	0	58.96
207	31.25	135.57	1	63.64
210	39.78	150.70	2	91.22
214	32.87	137.60	0	64.90
215	43.01	151.76	2	98.62
216	42.65	160.18	2	106.82
217	47.67	203.23	21	122.68
218	34.13	143.18	1	70.27

Appendix B

219	38.40	155.85	2	84.32
220	40.38	155.40	2	91.42
221	33.91	149.39	1	68.76
224	40.82	168.97	5	96.26
226	31.11	134.03	1	61.18
228	37.34	150.24	2	80.38
230	36.73	150.66	1	82.75
231	37.06	137.29	1	88.04
232	28.93	137.60	1	55.74
233	41.90	159.23	3	105.56
234	24.31	131.94	1	44.69
236	34.46	136.56	1	76.22
237	34.11	156.39	3	68.84
238	37.59	170.22	3	79.03
239	33.50	140.96	1	66.37
240	38.09	149.06	3	79.79
247	28.95	133.88	0	59.72
248	30.42	132.70	0	60.86
249	31.89	144.58	0	70.58
250	25.36	124.46	0	48.11
251	27.77	132.12	0	56.33
252	34.48	151.35	2	73.68
253	37.80	152.12	1	87.99
254	30.83	133.86	0	60.25
255	35.83	140.75	0	80.30
256	30.38	131.05	0	60.34
257	27.71	126.75	0	51.84
258	30.65	137.02	0	61.65
259	30.06	132.55	0	59.75
260	29.53	130.54	0	55.53
261	33.21	134.92	0	65.32
262	29.01	126.68	0	54.95
263	28.42	128.97	0	55.17
264	32.63	141.44	1	68.27
265	41.32	178.97	3	95.45

Appendix B

266	31.44	133.91	0	64.79
267	30.34	129.97	0	57.54
268	33.23	138.84	0	67.79
269	29.81	130.93	0	64.30
270	30.92	142.22	0	66.53
271	25.76	124.36	0	49.03
272	27.75	126.76	0	52.90
273	45.99	187.80	8	113.38
274	31.99	131.71	0	65.24
275	50.98	217.84	62	123.13
277	35.52	151.55	1	77.45
278	30.13	130.37	0	58.57
279	26.64	125.13	0	49.18
280	32.84	139.00	0	69.55
281	36.93	149.64	1	78.25
282	31.23	133.24	0	60.11
283	35.74	137.18	0	72.01
284	35.06	148.29	1	75.58
285	23.34	122.15	0	42.82
286	29.14	129.45	0	56.64
287	32.49	138.64	1	66.25
288	30.72	135.00	0	60.82
289	26.55	124.02	0	49.13
290	27.56	125.13	0	51.81
291	26.81	124.20	0	49.59
292	28.59	126.45	0	53.69
293	31.22	135.65	0	61.35
294	30.94	132.31	0	64.10
295	38.37	166.80	2	84.70
296	29.30	128.51	0	57.12
297	33.66	146.02	1	71.92
298	29.68	131.22	0	58.18
299	26.71	124.59	0	50.31
300	31.25	131.36	0	63.41
301	32.68	139.58	0	69.85

Appendix B

302	30.55	133.18	0	61.49
303	29.19	131.04	0	57.01
304	29.15	130.77	0	56.01
305	28.61	129.63	0	54.23
306	28.76	127.64	0	54.95
307	29.27	128.61	0	55.76
308	28.34	129.12	0	53.55
309	28.67	126.54	0	53.87
311	29.35	129.47	0	56.79
312	29.34	125.03	0	56.69
313	34.13	146.72	1	72.86
314	28.12	126.14	0	54.23
315	24.60	124.11	0	46.06
316	30.00	130.16	0	58.89
317	31.30	131.82	0	66.99
318	29.77	134.92	0	58.77
319	27.80	129.51	0	54.35
320	28.73	135.84	0	59.66
321	25.03	122.94	0	46.65
322	24.66	123.81	0	45.58
323	26.22	126.44	0	50.73
324	24.23	122.94	0	44.25
325	25.81	125.83	0	50.09
326	31.23	144.56	0	66.89
327	25.22	122.93	0	47.08
328	27.71	131.34	0	55.02
329	31.55	144.51	0	68.04
330	27.11	130.33	0	53.36
331	27.86	128.29	0	55.19
332	28.27	132.19	0	56.61
333	27.77	124.68	0	55.08
334	24.24	121.55	0	44.44
335	24.58	122.92	0	45.76
336	24.36	122.22	0	44.96
337	25.66	126.49	0	48.15

Appendix B

338	26.63	130.61	0	51.16
339	24.50	123.03	0	44.91
340	25.56	123.74	0	47.98
341	25.86	126.31	0	49.51
342	24.64	124.60	0	45.36
343	24.75	123.18	0	45.54
344	27.09	125.29	0	51.65
345	29.97	131.99	0	59.45
346	32.24	138.05	0	67.18
347	28.21	126.03	0	53.86
348	28.71	130.53	0	55.48
349	27.29	125.24	0	51.13
350	32.23	136.70	0	66.03
351	28.37	124.85	0	53.84
352	32.23	134.39	0	65.72
353	28.67	129.43	0	54.40
354	28.40	125.25	0	53.33
355	28.40	125.62	0	53.41
357	27.40	124.60	0	51.14
358	31.50	136.14	0	63.43
359	25.68	123.62	0	47.09
360	26.63	124.75	0	50.74
361	26.47	125.12	0	49.99
362	27.49	127.53	0	53.73
363	29.14	131.97	0	57.15
364	29.36	129.78	0	60.96
365	28.60	129.12	0	57.23
366	29.20	131.77	0	58.22
368	29.06	129.76	0	57.01
369	29.46	131.62	0	58.85
370	28.65	128.35	0	55.81
371	25.95	122.89	0	48.04
372	27.05	125.89	0	51.87
373	29.44	131.12	0	59.40
374	27.31	124.36	0	51.76

Appendix B

375	30.21	136.74	0	60.80
376	35.10	157.10	3	77.37
377	29.09	131.73	0	56.17
378	28.77	127.80	0	55.23
379	28.32	126.67	0	53.91
380	30.25	128.05	0	58.46
381	33.09	149.27	0	67.34
382	33.89	141.00	0	70.89
383	33.81	136.11	0	71.25
384	31.36	134.10	0	62.51
385	28.48	128.24	0	53.68
386	31.58	136.41	0	63.39
387	30.36	134.78	0	59.36
388	33.89	138.55	0	71.61
389	30.98	133.66	0	60.62
390	34.45	152.06	3	72.12
391	31.10	135.02	0	60.91
392	30.76	130.21	0	60.71
394	29.22	127.45	0	56.56
395	33.78	139.47	2	70.52
396	39.32	165.00	2	89.35
397	29.58	126.12	0	56.32
398	36.14	141.16	0	72.47
399	38.43	160.94	5	83.09
400	29.32	127.61	0	55.50
401	44.26	181.14	3	108.16
402	32.25	132.52	0	64.84
403	35.59	146.78	2	75.64
404	29.48	128.22	0	56.03
405	29.73	128.52	0	56.68
406	30.17	132.28	0	57.06
407	30.49	134.84	0	57.92
408	35.95	153.47	3	73.61
409	45.33	189.16	9	105.94
410	36.30	141.05	0	74.63

Appendix B

411	30.27	132.51	0	58.54
412	35.70	144.11	2	75.29
413	28.51	126.10	0	53.79
414	31.82	133.40	0	64.81
415	34.05	147.84	2	72.40
416	28.49	126.49	0	54.06
417	32.63	137.93	1	67.65
418	29.59	127.10	0	56.59
419	33.68	146.55	2	66.30
420	48.20	197.69	17	124.19
421	31.13	129.09	0	60.61
422	29.43	133.07	0	58.69
425	30.17	129.30	0	58.07
426	29.21	125.98	0	56.16
427	33.07	136.55	0	70.09
428	33.72	137.78	0	71.35
429	30.20	133.64	0	65.52
430	30.80	128.59	0	59.83
431	32.52	138.49	0	66.06
432	28.98	136.02	0	59.47
433	29.14	135.06	0	59.77
434	28.21	138.76	0	54.63
435	26.51	140.93	0	50.08
436	29.62	142.58	0	57.72
437	27.41	153.93	1	53.65
438	30.17	160.01	2	60.87
439	27.96	140.47	1	53.76
440	31.35	143.27	1	61.90
441	31.98	177.47	5	65.40
442	28.92	162.48	2	60.71
443	31.86	159.39	2	69.15
444	28.91	161.28	2	61.29
445	27.82	142.02	1	55.24
446	29.47	144.89	1	60.49
447	30.21	166.23	2	66.54

Appendix B

448	26.51	143.66	1	50.27
449	35.15	174.71	6	75.37
450	33.52	181.41	6	69.17
451	33.14	152.92	1	67.66
452	36.74	169.71	2	90.83
453	31.60	168.85	3	70.33
454	33.61	164.63	2	76.84
455	31.91	167.23	4	70.53
456	30.39	166.23	2	65.29
457	33.68	161.82	2	78.07
458	29.43	155.47	1	60.93
459	30.51	155.82	1	64.24
462	37.67	161.95	2	85.01
465	36.36	167.38	2	93.45
468	32.26	156.55	1	68.52
472	29.12	142.97	1	58.32
473	27.12	153.36	1	54.30
474	30.63	146.71	1	64.28
475	27.21	144.01	1	54.10
476	35.96	152.99	2	75.10
477	33.81	147.58	2	68.74
478	31.97	175.56	4	65.80
479	30.18	143.92	1	59.21
480	33.26	148.56	2	67.48
481	32.75	148.24	1	66.05
482	30.61	145.18	1	60.18
483	31.01	145.43	1	61.46
484	29.52	143.89	1	57.44
485	28.51	143.60	1	58.63
487	28.40	145.31	1	57.75
488	35.00	169.09	3	80.25
489	29.51	156.18	1	61.98
491	30.81	165.45	2	64.57
494	31.60	150.80	2	69.81
495	28.65	154.46	2	57.36

Appendix B

496	34.27	152.51	2	75.02
499	30.80	143.78	1	63.97
502	29.64	157.42	2	60.72
503	31.97	152.37	1	65.41
504	28.41	147.13	1	54.77
505	30.97	158.91	1	63.16
506	30.98	160.76	1	63.39
507	29.72	150.56	1	59.78
508	28.58	151.67	1	56.78
509	28.92	158.49	1	59.32
510	29.95	149.07	1	60.55
511	26.03	149.77	1	49.81
512	31.45	160.00	2	66.82
513	43.46	182.78	4	100.95
514	27.42	145.97	1	53.69
517	28.80	150.84	1	60.02
518	29.22	149.16	1	59.65
519	28.43	149.05	1	59.49
520	28.40	153.03	1	59.12
521	30.64	153.87	1	67.94
524	30.26	142.60	1	61.13
525	44.24	190.03	11	107.83
526	37.25	162.90	1	83.74
528	35.82	166.99	2	79.50
529	30.32	156.45	1	62.01
535	35.25	184.33	6	79.64
536	32.64	159.75	2	67.72
539	25.91	137.98	1	49.04
540	35.16	164.01	4	77.60
541	29.09	153.72	1	58.57
542	31.74	157.10	1	65.90
546	37.51	159.06	3	88.32
547	29.07	147.90	1	58.21
550	30.65	159.87	2	62.72
551	32.91	153.14	1	70.27

Appendix B

555	38.21	163.30	4	87.47
556	33.14	158.30	1	70.50
557	31.62	158.01	1	66.46
558	30.08	151.38	1	61.13
559	29.13	153.48	1	57.94
560	32.70	165.46	2	69.92
561	30.57	148.43	1	62.57
562	32.70	156.26	1	69.47
563	31.57	155.45	1	65.95
564	31.15	154.42	1	64.28
565	30.24	152.55	1	60.81
566	30.66	151.74	1	62.06
567	32.10	152.38	1	65.83
568	33.23	152.11	1	69.75
569	30.80	154.49	1	62.69
570	30.18	154.09	1	60.82
571	29.63	152.00	1	59.10
572	28.85	152.11	1	56.54
573	29.89	151.19	1	60.16
574	31.70	152.34	1	66.85
575	29.64	151.95	1	59.00
576	28.57	144.39	1	57.25
580	31.99	166.75	2	69.57
581	33.13	169.98	3	73.57
582	30.23	148.62	1	61.13
588	29.18	154.60	1	60.45
597	34.20	150.81	2	73.04
605	36.51	149.21	2	83.22
606	38.35	171.28	2	85.20
610	29.09	143.66	1	60.10
611	38.51	153.33	3	83.64
612	29.89	149.17	1	62.04
613	31.99	158.83	2	70.33
614	29.38	153.87	1	64.49
615	29.29	143.45	1	58.81

Appendix B

616	31.11	147.71	1	64.29
617	31.81	145.83	1	70.28
620	27.22	144.69	1	53.12
621	26.25	135.45	1	49.05
622	28.75	141.93	1	55.29
623	32.04	144.21	1	66.25
627	26.28	145.88	1	50.98
628	30.63	146.21	1	62.92
629	32.78	173.89	3	71.01
630	32.46	147.22	1	71.43
631	28.19	152.91	1	56.47
632	30.73	159.51	2	63.85
636	26.12	142.65	1	52.68
638	29.00	152.29	1	57.80
640	29.48	140.72	0	57.98
641	30.71	148.98	1	63.52
642	31.30	161.64	3	65.76
643	34.69	181.60	6	71.63
644	39.52	173.61	4	91.85
645	30.62	144.75	1	60.37
646	34.93	169.98	3	79.76
647	33.54	147.09	2	71.27
648	29.96	158.25	1	62.03
649	32.36	175.53	5	65.89
653	31.02	160.87	1	64.22
654	30.46	154.60	1	62.22
655	25.42	139.65	1	47.81
657	30.72	167.38	3	64.56
658	32.04	172.15	3	67.82
659	32.73	158.59	1	70.45
661	28.32	154.56	1	56.80
662	32.98	150.16	1	71.48
663	27.91	139.39	1	54.33
664	29.85	159.62	1	61.89
665	35.28	151.57	1	78.65

Appendix B

666	29.21	151.16	1	59.68
667	31.05	154.42	1	63.83
668	31.61	145.65	1	62.70
669	32.37	164.05	2	69.43
670	32.09	151.46	1	67.77
671	30.56	144.47	1	60.14
672	27.08	149.30	1	52.59
673	29.30	146.35	1	56.96
674	32.51	148.46	1	65.45
675	29.08	141.05	1	56.14
676	30.08	151.43	1	62.34
677	32.15	154.74	1	69.33
678	31.19	163.70	2	68.04
679	33.00	154.45	1	69.42
680	32.58	153.55	1	72.90
681	36.35	176.67	3	81.75
682	27.82	139.48	0	55.83
684	31.86	165.80	2	68.78
685	31.29	146.77	1	62.06
686	28.97	150.88	1	57.28
687	37.95	159.50	2	81.19
688	32.51	150.11	1	72.13
689	35.92	168.19	4	83.37
690	31.19	149.30	1	64.81
691	30.71	148.96	1	62.41
692	33.89	162.74	2	77.94
693	32.81	153.32	1	71.49
694	31.52	168.13	3	69.98
695	33.00	171.03	3	70.74
696	29.21	147.14	1	59.80
699	25.25	133.57	0	47.75
702	29.59	156.88	1	60.12
703	32.97	151.00	1	67.77
704	36.78	168.79	2	78.49
705	31.11	168.10	3	65.58

Appendix B

706	30.99	162.43	2	66.54
707	28.27	153.41	1	55.77
711	37.95	166.61	4	87.17
713	30.41	145.51	1	65.80
714	43.92	168.98	4	101.40
715	28.32	156.09	1	56.56
716	29.88	153.26	1	61.24
717	28.12	150.14	1	58.10
718	31.23	166.74	3	65.25
719	25.47	145.11	1	48.49
724	29.40	143.41	1	56.88
726	32.43	175.37	5	66.05
727	32.62	164.07	2	69.50
728	30.94	172.22	3	62.36
729	26.33	136.57	1	49.57
730	26.82	137.00	1	50.73
732	29.41	145.35	1	60.05
734	38.09	151.93	2	80.76
738	31.84	156.04	1	66.78
743	31.44	162.47	3	66.41
747	27.42	146.16	1	53.96
748	27.48	145.45	1	53.30
749	25.84	143.97	1	50.39
750	25.15	137.24	1	46.95
751	29.12	142.57	1	58.43
753	29.26	148.53	1	58.10
756	28.37	155.27	1	57.24
757	28.68	159.02	2	60.44
759	33.16	145.72	0	71.43
760	29.69	146.07	1	59.77
761	26.60	139.94	0	50.62
762	25.48	146.46	1	48.64
763	30.30	143.61	1	62.76
764	30.68	171.39	3	61.65
766	26.97	145.77	1	53.07

Appendix B

767	29.36	152.57	1	57.89
768	27.84	144.32	1	55.33
769	27.87	153.12	1	55.86
770	33.36	159.22	1	73.22
771	31.75	145.67	1	70.03
772	31.64	148.97	1	66.53
773	27.63	140.14	1	54.74
774	27.17	146.94	1	53.57
775	30.55	162.14	2	62.84
776	30.84	160.24	1	63.96
777	30.29	159.45	1	61.57
778	29.66	158.86	1	60.11
779	36.09	158.94	1	80.10
780	27.23	146.28	1	53.01
781	26.33	147.32	1	52.16
782	29.47	143.96	1	59.73
783	29.63	153.24	1	59.79
784	29.55	149.72	1	59.06
785	28.20	153.41	1	56.51
786	29.24	149.64	1	60.20
787	28.35	155.15	1	57.17
788	30.24	143.51	1	61.77
789	27.99	139.18	1	57.21
790	34.79	151.15	1	77.01
791	27.34	137.79	1	53.04
792	32.20	151.83	1	67.65
793	37.56	181.86	6	86.68
795	35.63	172.77	3	78.12
796	28.50	157.61	1	57.62
798	37.14	159.79	3	84.50
800	31.93	156.00	1	67.15
801	31.93	142.14	0	65.48
802	28.14	135.51	0	57.45
803	25.03	132.17	0	47.73
804	32.18	147.12	0	66.67

Appendix B

805	26.35	133.37	0	50.58
806	28.39	133.87	0	55.96
807	31.22	137.53	0	63.39
808	27.67	131.98	0	53.81
811	29.36	135.58	0	57.31
813	29.64	137.33	0	60.35
814	31.71	150.69	1	66.25
818	29.56	138.40	0	58.04
820	29.78	137.31	0	58.65
821	29.69	135.87	0	57.07
823	30.04	138.52	0	57.82
824	31.36	139.84	0	62.09
825	33.13	144.44	0	71.51
827	36.63	149.77	2	85.16
829	34.98	151.34	1	74.96
830	32.65	150.70	1	69.05
832	35.12	146.30	0	76.68
833	41.14	174.86	3	101.26
834	33.67	144.15	0	73.28
835	36.44	164.31	3	81.34
836	30.55	149.67	1	62.40
837	27.63	142.61	0	55.31
838	27.87	144.57	0	55.34
839	34.73	156.38	1	76.01
841	32.74	148.31	0	67.83
842	30.63	146.40	1	61.25
845	28.18	139.36	0	54.65
847	28.09	138.93	0	54.67
848	26.94	134.15	0	51.61
849	30.25	141.64	0	61.99
850	26.35	132.80	0	50.20
851	27.60	142.15	1	54.22
852	32.30	146.37	1	70.27
853	28.96	150.69	1	59.44
854	27.58	135.99	0	55.83

Appendix B

855	27.04	140.07	0	54.25
856	26.45	135.49	0	51.02
857	28.28	135.18	0	55.13
859	29.29	134.78	0	57.25
860	27.62	131.78	0	52.71
861	28.40	136.81	0	55.29
862	29.19	135.39	0	57.06
863	31.02	144.80	1	63.15
864	30.54	141.68	0	61.01
865	33.75	150.05	2	70.50
869	32.17	138.84	0	63.98
870	29.98	139.59	0	58.61
873	29.63	140.32	0	58.45
877	30.84	143.13	0	62.97
879	30.60	139.27	0	60.74
882	32.64	147.18	1	66.98
883	30.21	136.72	0	60.18
884	29.03	136.92	0	56.81
885	29.75	140.28	0	57.24
886	29.72	139.56	0	57.45
887	29.39	137.10	0	56.43
888	29.92	138.47	0	57.35
889	31.20	144.81	1	61.83
890	29.39	140.55	0	56.47
891	29.81	141.06	0	57.99
892	32.69	152.15	1	68.22
893	29.36	139.95	0	56.10
894	28.92	140.75	0	55.31
895	30.31	145.39	0	59.10
896	29.23	139.39	0	55.39
897	28.97	137.61	0	55.17
898	29.12	134.21	0	55.39
899	29.20	140.00	0	56.30
900	30.40	144.87	1	60.20
901	29.50	141.63	0	57.77

Appendix B

902	31.25	147.22	1	64.24
903	30.09	143.53	1	60.01
904	29.45	139.45	0	57.93
905	30.07	144.16	0	57.36
906	28.86	142.26	1	55.38
907	29.49	149.65	1	56.82
908	29.31	139.78	1	57.92
909	29.74	139.35	0	58.81
910	28.74	139.64	0	56.26
911	28.19	136.36	0	54.78
914	28.73	140.20	1	55.80
915	29.61	144.86	1	59.08
916	28.93	144.88	1	57.15
918	29.46	146.38	1	58.68
919	29.45	137.79	0	58.63
923	31.53	144.70	1	63.81
924	29.92	143.15	1	59.27
925	29.40	151.97	1	58.64
926	29.22	146.63	1	58.30
927	27.19	140.84	1	51.99
928	28.52	142.45	1	55.73
929	28.09	143.10	1	55.27
930	27.45	141.46	1	53.36
931	27.33	140.69	1	54.65
932	27.05	140.28	1	52.25
933	27.11	140.16	1	52.14
934	29.06	141.12	1	58.06
935	28.80	144.74	1	57.84
936	28.48	151.95	1	56.67
937	26.89	142.64	1	51.90
938	29.29	156.93	1	59.17
939	30.20	161.43	2	61.72
940	29.64	149.21	1	59.53
941	34.67	154.82	1	77.19
942	26.70	142.98	1	50.99

Appendix B

943	30.98	152.68	1	65.79
944	28.42	147.15	1	54.51
945	29.47	154.07	1	57.31
946	28.04	147.48	1	55.75
947	28.25	148.71	1	56.64
948	28.05	149.50	1	53.76
949	28.16	133.90	0	53.87
950	27.61	151.89	1	55.55
951	28.67	145.24	1	58.42
952	29.05	140.74	1	57.09
953	27.79	149.46	1	53.83
954	28.19	146.81	1	55.11
955	30.04	162.10	1	61.59
956	30.38	159.63	1	62.08
957	29.61	159.23	1	60.97
958	28.68	140.28	1	57.21
959	28.91	145.01	1	57.46
960	28.88	153.15	1	57.53
961	27.14	143.35	1	52.74
962	27.02	144.57	1	52.60
963	25.75	129.70	0	48.52
964	25.36	130.00	0	48.09
965	25.72	133.66	0	49.00
966	24.82	133.40	0	47.10
967	24.14	130.82	0	45.31
968	24.22	129.93	0	45.36
969	25.68	139.71	0	48.28
970	25.71	132.68	0	48.67
971	26.21	137.12	1	49.08
972	29.74	139.18	0	58.27
973	29.94	142.91	0	57.58
974	28.88	134.97	0	55.27
975	27.64	134.36	0	52.23
976	27.13	132.80	0	51.26
977	27.40	137.51	0	52.84

Appendix B

979	33.28	143.20	0	69.55
980	29.20	136.60	0	56.62
981	28.59	135.25	0	54.70
982	35.75	164.91	2	79.16
983	31.55	144.96	1	65.49
984	26.63	132.70	0	50.66
985	31.66	144.23	0	65.60
986	28.70	138.09	0	56.23
987	25.54	130.39	0	48.07
988	30.33	144.24	1	61.63
989	29.69	155.29	1	59.99
990	44.59	205.14	23	110.53
991	28.29	136.46	0	55.15
992	28.89	141.68	0	57.25
993	30.91	141.52	0	62.64
994	32.31	141.72	0	66.76
995	32.21	139.67	0	65.65
996	24.21	130.59	0	45.47
997	30.72	146.00	1	62.95
998	29.82	138.49	0	59.17
999	33.55	153.16	1	69.72
1000	40.38	184.81	6	87.12
1001	34.58	161.91	2	74.77
1002	30.68	142.06	0	60.22
1003	33.66	146.54	0	68.85
1004	31.38	138.86	0	61.89
1005	35.27	165.34	2	77.87
1006	27.00	139.72	1	51.90
1007	28.19	139.63	0	53.41
1008	32.23	144.22	1	63.64
1009	33.20	140.36	0	66.99
1010	37.41	146.62	1	100.90
1011	31.91	136.83	1	65.71
1012	28.61	134.10	1	53.73
1013	27.91	134.46	1	52.49

Appendix B

1014	28.47	136.02	1	54.28
1015	32.26	141.39	1	64.09
1016	27.33	135.26	1	51.26
1017	28.01	136.03	1	53.00
1018	33.50	136.93	1	66.67
1019	35.02	143.14	2	71.52
1020	32.20	145.91	1	63.37
1021	37.82	161.53	4	79.58
1022	32.40	137.08	1	63.62
1023	32.61	140.83	1	64.06
1024	34.75	144.59	1	70.58
1025	31.03	135.20	1	60.17
1026	35.18	139.41	1	71.17
1027	30.70	139.07	1	60.51
1028	34.22	143.53	1	73.21
1029	36.15	137.11	1	78.49
1030	28.03	133.40	1	53.61
1031	27.98	128.06	1	52.80
1032	33.37	136.44	1	67.26
1033	40.10	162.33	4	92.15
1034	36.68	159.28	3	81.11
1035	29.82	133.32	1	57.14
1036	36.17	142.98	2	81.18
1037	32.41	142.48	1	64.57
1038	31.32	136.44	1	62.32
1039	31.24	136.41	1	63.02
1040	29.54	146.08	1	59.69
1041	27.28	140.58	1	53.39
1042	31.24	144.33	1	61.97
1043	39.79	152.03	2	89.16
1044	41.88	166.09	5	96.49
1045	33.49	148.03	1	68.11
1046	36.80	141.71	1	79.27
1047	36.90	162.97	3	83.51
1048	44.92	172.17	4	110.61

Appendix B

1049	33.40	139.07	1	71.40
1050	29.12	140.32	1	59.59
1051	29.53	131.68	1	60.13
1052	28.31	132.86	1	55.83
1053	28.45	129.14	1	56.48
1054	33.47	145.22	1	71.89
1056	35.38	141.59	1	74.55
1057	32.59	143.74	1	64.27
1058	31.44	143.14	1	64.40
1059	32.27	139.69	1	64.24
1060	32.14	141.17	1	63.32
1061	27.92	129.44	1	52.94
1062	31.74	160.78	3	66.82
1063	33.23	134.61	1	66.36
1064	27.19	134.44	1	52.86
1065	29.70	138.99	1	59.76
1066	31.30	135.68	1	61.40
1067	29.76	132.97	1	57.33
1069	32.75	141.34	1	73.47
1070	29.57	135.40	1	57.11
1071	38.46	144.49	2	81.47
1072	37.44	152.77	2	78.55
1073	38.11	145.48	1	80.74
1074	34.85	149.66	1	71.43
1075	27.10	127.87	1	50.67
1076	34.85	139.59	1	79.15
1077	28.18	128.66	1	56.23
1078	30.10	129.66	1	57.92
1079	31.34	132.10	1	62.34
1080	33.31	135.55	1	66.71
1081	32.78	148.68	1	65.72
1082	29.35	127.35	1	55.61
1083	29.62	132.33	1	56.52
1084	28.22	125.78	1	52.89
1085	35.63	138.98	1	78.67

Appendix B

1086	29.21	129.16	1	55.13
1087	27.14	133.63	1	51.08
1088	30.99	131.13	1	60.66
1089	26.08	127.23	1	48.90
1091	28.02	134.33	1	52.20
1092	32.68	158.03	3	70.99
1093	29.60	133.62	1	59.30
1094	25.17	132.45	1	46.61
1095	25.93	130.29	1	47.94
1096	35.49	174.12	5	80.50
1097	34.78	153.63	1	72.60
1098	26.77	134.15	1	49.99
1099	26.98	131.54	1	50.82
1100	35.91	164.85	4	77.74
1101	32.28	141.61	1	65.81
1102	32.52	144.65	1	63.87
1103	45.42	166.75	4	130.74
1104	39.01	174.24	5	88.01
1105	37.66	159.04	2	79.76
1106	29.57	133.87	1	57.13
1107	26.71	131.73	1	49.77
1108	28.07	134.66	1	52.78
1109	26.17	125.21	1	48.09
1110	25.59	124.51	1	47.44
1111	26.68	133.28	1	50.01
1112	28.37	133.56	1	53.33
1113	28.58	131.97	1	54.09
1114	28.34	133.84	1	54.93
1115	34.79	139.55	1	76.50
1118	26.80	129.95	1	51.38
1119	28.53	133.52	1	53.75
1120	33.39	142.46	1	67.87
1437	31.47	146.87	2	61.77
1438	30.92	139.54	1	59.78
1439	37.98	165.17	2	81.78

Appendix B

1440	34.18	150.03	2	70.53
1441	36.04	163.39	2	76.29
1442	33.59	147.70	1	66.95
1443	32.51	149.36	2	64.50
1444	32.60	147.75	1	67.31
1445	31.27	157.69	3	60.53
1446	32.28	147.29	1	64.86
1447	26.84	146.54	1	51.14
1448	25.68	143.57	0	48.38
1449	27.14	148.42	1	51.75
1450	29.91	149.97	1	60.01
1451	28.84	148.69	0	56.69
1452	32.59	153.32	1	70.45
1453	32.60	145.41	1	69.60
1454	28.20	143.11	0	54.08
1455	28.15	137.38	0	54.27
1456	37.60	171.41	3	86.36
1457	32.23	159.74	2	66.38
1458	31.98	151.89	1	64.21
1459	30.10	142.82	1	58.63
1460	35.98	152.24	2	74.88
1461	39.08	179.51	6	84.94
1462	40.99	164.26	4	89.38
1463	44.41	209.61	25	100.87
1464	37.41	159.63	2	78.71
1465	30.38	157.07	1	61.09
1466	31.31	153.03	1	63.79
1467	27.89	142.08	0	54.67
1468	28.80	145.14	0	59.04
1469	31.24	151.40	2	62.66
1470	29.27	143.46	1	56.82
1471	27.27	146.47	0	53.25
1472	25.38	139.45	0	48.04
1473	26.12	141.97	0	50.17
1474	32.44	144.98	1	67.09

Appendix B

1475	32.26	153.31	1	68.84
1476	32.99	148.27	0	67.96
1477	23.46	140.97	0	43.67
1478	26.60	140.90	0	50.86
1479	29.53	145.23	1	57.42
1480	31.11	144.14	1	60.03
1481	37.71	163.71	3	79.71
1482	36.23	150.92	2	76.01
1483	33.40	161.77	2	66.79
1484	35.63	162.89	2	74.93
1485	29.23	144.11	1	57.31
1486	31.23	153.82	1	63.44
1487	30.00	142.64	1	58.29
1488	40.11	165.61	3	88.20
1489	31.31	147.93	1	61.56
1490	37.03	168.18	2	84.37
1491	28.91	134.87	0	56.76
1492	28.63	138.11	0	56.10
1493	30.62	141.73	1	61.32
1494	35.26	167.11	2	74.76
1495	35.17	152.06	3	75.53
1496	35.72	153.93	3	79.80
1497	31.30	135.85	0	62.24
1498	32.19	139.61	0	65.64
1499	34.00	146.80	1	78.92
1500	32.45	139.11	0	66.81
1501	34.11	149.49	1	71.33
1502	41.66	181.10	2	95.25
1503	37.51	158.36	1	81.80
1504	35.59	156.08	1	74.66
1505	28.29	129.27	0	53.96
1506	28.14	128.18	0	54.31
1507	31.79	145.78	1	65.42
1508	31.77	144.37	1	65.58
1509	40.03	156.31	1	92.27

Appendix B

1510	29.82	135.56	0	58.43
1511	33.84	139.36	0	70.87
1512	32.52	141.01	0	66.66
1513	32.22	141.47	1	65.29
1514	38.00	153.61	0	82.08
1515	33.60	150.76	1	70.56
1516	28.49	132.04	0	55.22
1517	28.05	130.60	0	53.61
1518	31.23	138.46	0	62.91
1519	29.61	135.12	0	57.14
1520	28.60	128.80	0	54.39
1521	30.47	140.14	1	61.60
1522	29.58	137.83	0	58.10
1523	32.83	142.57	1	67.79
1524	32.10	145.93	1	67.25
1525	32.48	138.35	0	68.34
1526	31.11	141.26	0	63.91
1527	28.81	136.26	0	56.03
1528	27.69	131.99	0	53.39
1529	30.06	133.12	0	57.86
1530	29.08	133.91	0	57.15
1531	28.10	132.91	0	54.83
1532	27.89	131.11	0	53.74
1533	27.40	131.57	0	52.93
1534	28.43	133.72	0	56.32
1535	30.17	134.19	0	62.39
1536	29.90	133.39	0	62.42
1537	30.11	133.03	0	60.78
1538	29.82	134.46	0	59.01
1538	29.77	134.62	0	58.89
1539	30.89	128.82	0	64.59
1539	30.86	129.20	0	64.50
1540	32.42	141.35	0	68.95
1540	32.39	142.51	0	68.86
1541	28.60	130.74	0	55.16

Appendix B

1541	28.55	130.73	0	55.05
1542	28.45	130.96	0	54.39
1543	28.82	129.74	0	55.09
1544	31.74	141.83	1	63.74
1545	25.47	124.60	0	48.41
1546	26.34	126.41	0	50.05
1547	30.16	136.53	0	61.51
1548	36.69	149.89	0	90.97
1549	29.75	140.50	0	62.85
1550	27.99	136.01	0	56.92
1551	29.57	140.93	0	60.45
1551	29.53	140.89	0	60.35
1552	28.93	133.67	0	58.17
1553	27.14	133.25	0	53.89
1554	28.74	134.38	0	56.98
1555	27.05	131.68	0	52.79
1556	29.96	139.50	0	60.13
1557	28.37	134.02	0	55.15
1558	27.54	132.85	0	53.12
1559	31.16	140.75	0	62.79
1560	29.81	136.90	0	59.58
1561	28.84	136.09	0	56.00
1562	29.88	136.92	0	59.51
1563	29.53	139.06	0	57.20
1564	31.45	139.44	0	62.90
1565	32.04	143.91	1	64.98
1566	32.74	142.67	1	67.58
1567	32.16	140.73	1	66.25
1568	31.03	136.10	0	60.48
1569	33.68	138.45	0	68.90
1570	35.75	141.78	0	73.88
1571	29.73	133.29	0	56.89
1572	40.18	163.76	1	86.65
1573	39.52	162.70	2	84.50
1574	32.27	139.93	0	62.60

Appendix B

1575	43.70	171.79	7	97.86
1576	40.34	152.68	2	83.36
1577	33.18	138.84	0	66.04
1578	30.07	133.94	0	57.81
1579	31.74	140.40	0	62.61
1580	35.72	138.71	1	75.68
1581	32.23	144.80	1	65.32
1582	33.71	136.57	0	68.66
1583	32.09	143.96	0	63.82
1584	33.13	139.96	0	67.66
1585	40.19	167.21	2	88.26
1586	30.58	135.14	0	58.15
1587	30.16	134.22	0	57.41
1588	35.86	144.87	2	73.05
1589	30.05	134.64	0	56.89
1590	30.61	138.37	0	59.32
1591	32.90	145.03	1	67.12
1592	31.37	140.84	0	61.77
1593	29.59	128.27	0	55.47
1594	29.93	132.04	0	57.58
1595	35.81	141.90	1	72.33
1596	33.51	150.02	2	66.14
1597	29.39	127.14	0	55.19
1598	31.29	141.63	0	63.37
1599	29.88	134.42	0	58.90
1600	30.21	132.53	0	59.28
1601	25.68	124.40	0	48.11
1602	28.32	126.22	0	55.39
1603	33.30	143.56	1	70.33
1604	30.05	137.97	1	59.39
1605	30.78	130.50	0	59.50
1606	24.31	122.00	0	44.41
1607	27.58	125.77	1	50.87
1608	29.21	127.97	0	54.94
1609	37.91	153.85	1	91.68

Appendix B

1610	50.88	196.67	14	126.37
1611	41.11	156.10	1	92.53
1612	34.41	147.06	2	72.43
1613	37.84	144.80	1	80.98
1614	34.91	137.17	0	74.12
1615	39.89	166.29	3	88.06
1616	39.43	165.82	2	92.18
1617	34.76	159.41	3	76.26
1618	37.64	165.59	3	86.68
1619	30.20	128.69	0	57.77
1620	31.56	134.04	1	61.45
1621	44.26	168.32	3	111.49
1622	32.32	144.26	1	62.70
1623	34.03	142.41	1	73.16
1624	26.37	123.10	0	48.59
1625	34.79	158.01	3	76.99
1626	28.04	127.53	0	54.93
1627	30.82	141.29	2	64.55
1628	25.26	122.29	0	46.19
1629	25.26	122.10	0	46.18
1630	24.61	122.05	0	45.02
1631	25.35	122.79	0	46.58
1632	25.08	122.82	0	46.21
1633	24.54	122.61	0	45.20
1634	24.70	122.51	0	45.14
1636	25.25	121.99	0	46.35
1637	24.59	122.01	0	44.87
1638	27.34	127.60	0	52.28
1639	25.51	122.16	0	47.05
1640	25.29	122.34	0	46.71
1642	25.97	123.00	0	48.62
1644	25.94	122.89	0	48.99
1645	26.84	123.79	0	49.98
1648	26.47	124.42	0	48.82
1649	26.07	124.25	0	47.98

Appendix B

1650	26.05	122.80	0	48.01
1651	27.16	123.84	0	50.33
1652	26.15	123.62	0	48.04
1653	26.30	123.26	0	48.41
1654	27.26	126.37	1	50.83
1655	26.85	127.52	1	49.78
1656	26.29	125.07	1	48.65
1657	26.03	124.97	1	48.26
1658	26.88	126.24	1	49.95
1659	26.03	124.37	1	48.54
1660	30.06	136.15	1	57.53
1661	27.47	126.12	1	51.27
1662	27.81	125.45	1	52.19
1663	27.31	124.84	0	50.79
1664	27.56	125.42	0	51.38
1665	27.98	126.14	0	52.36
1666	27.98	125.67	1	52.52
1667	27.23	125.09	0	50.68
1668	27.59	125.30	0	51.62
1669	27.86	125.25	1	52.17
1671	26.95	124.08	0	49.89
1672	30.32	130.02	0	58.56
1673	27.29	124.34	0	51.01
1674	29.42	127.40	0	56.01
1675	29.72	125.94	0	57.00
1676	30.54	130.06	0	58.73
1677	28.63	125.24	0	53.97
1678	27.55	124.20	0	51.18
1680	29.21	125.38	0	55.41
1681	29.72	129.28	0	57.43
1682	30.55	128.29	1	57.89
1683	29.65	126.43	0	56.04
1684	30.15	127.66	0	57.80
1685	28.87	126.73	0	54.39
1686	29.87	127.17	1	56.86

Appendix B

1687	33.20	133.09	1	68.07
1688	27.93	128.61	1	51.81
1689	27.26	125.91	1	50.66
1690	29.52	127.77	0	56.19
1691	29.25	128.24	0	54.82
1692	35.44	144.10	1	70.93
1693	30.14	129.44	1	57.41
1694	29.00	127.47	0	54.08
1695	28.52	128.62	1	53.36
1696	32.72	132.82	0	65.83
1697	31.26	132.97	1	59.28
1698	29.23	127.07	0	55.61
1699	29.59	128.74	0	56.14
1700	29.25	128.56	0	55.45
1701	28.39	126.97	0	53.21
1702	29.75	127.44	0	56.67
1703	28.56	129.40	0	53.47
1704	28.91	131.64	0	54.06
1705	34.35	136.13	0	72.03
1706	30.40	130.34	0	59.25
1708	29.93	128.58	0	57.65
1709	29.96	129.45	0	57.86
1710	31.78	131.21	0	63.04
1711	25.70	122.74	0	47.10
1712	27.89	125.60	1	52.36
1713	28.15	127.86	1	52.53
1714	27.97	127.59	1	51.97
1715	29.11	127.87	0	54.66
1716	28.95	126.37	0	55.40
1717	30.14	127.24	0	57.30
1718	27.53	126.56	1	51.07
1719	27.47	125.06	0	51.78
1720	25.35	123.18	0	46.60
1721	28.23	125.92	0	53.45
1722	42.31	199.28	18	105.28

Appendix B

1723	27.78	124.29	0	51.69
1724	30.69	130.52	0	59.14
1725	31.13	133.97	1	62.76
1726	43.17	162.93	1	99.76
1727	32.99	153.08	1	65.99
1728	41.77	184.31	9	93.27
1729	30.75	144.47	0	59.52
1730	33.14	143.15	0	66.41
1731	31.71	145.22	2	62.65
1732	33.48	153.58	1	66.54
1733	29.50	142.48	0	56.25
1734	35.55	158.27	1	73.69
1735	32.37	152.79	1	64.83
1736	32.03	157.35	1	69.43
1737	30.86	139.17	0	59.60
1738	32.22	143.50	0	63.13
1739	33.72	143.27	1	66.37
1740	35.13	155.79	2	70.44
1741	36.97	153.80	1	78.74
1742	32.38	138.91	0	63.78
1743	34.86	145.74	1	71.40
1744	34.35	142.47	0	69.73
1745	32.11	134.54	0	64.52
1746	34.72	148.62	1	71.50
1747	36.25	148.48	2	74.53
1748	32.21	144.67	1	63.21
1749	40.59	152.49	1	93.74
1750	33.51	140.54	0	68.52
1751	34.63	141.75	0	73.19
1752	30.36	133.45	0	58.79
1753	34.42	154.16	1	75.56
1754	33.52	145.61	1	69.96
1755	31.23	143.35	1	62.42
1756	36.81	153.88	1	88.65
1757	30.41	145.30	1	61.12

Appendix B

1758	31.12	142.40	0	61.82
1759	27.67	150.20	1	53.21
1760	32.11	139.59	0	63.61
1761	33.73	159.15	1	68.81
1762	32.13	158.81	1	68.67
1763	43.82	160.27	2	98.85
1764	29.95	151.51	1	59.12
1765	32.84	158.21	1	66.03
1766	32.63	164.04	2	67.49
1767	30.96	154.56	1	61.20
1768	31.88	154.58	1	65.30
1769	31.30	159.57	1	63.94
1770	32.97	166.39	2	68.21
1771	32.94	160.97	2	68.04
1772	39.12	196.21	16	83.77
1773	35.69	152.43	3	71.78
1774	40.52	184.94	12	90.73
1775	39.66	198.41	16	87.14
1776	37.03	187.85	8	78.26
1777	42.82	165.90	5	93.41
1778	39.51	194.80	16	86.17
1779	34.69	151.94	1	72.02
1780	35.80	151.45	2	76.87
1781	27.83	151.53	1	54.45
1782	25.93	146.57	0	48.93
1783	25.95	146.54	0	49.02
1784	26.87	147.30	1	50.53
1785	27.01	147.78	1	51.21
1786	26.14	147.10	0	49.41
1787	26.22	147.30	0	49.52
1788	26.22	147.33	0	49.53
1789	41.41	167.89	3	94.13
1790	35.74	157.13	2	74.06
1791	42.60	175.09	5	99.95
1792	35.35	153.70	1	72.15

Appendix B

1793	35.33	148.36	2	72.16
1794	36.80	148.83	2	76.15
1795	43.67	172.15	4	97.16
1796	32.95	167.29	3	66.53
1797	42.91	185.14	9	97.08
1798	38.62	154.20	3	81.64
1799	36.96	167.97	2	78.06
1800	33.27	144.65	1	65.27
1801	34.46	150.69	1	70.47
1802	36.32	152.16	2	74.23
1803	47.35	171.03	5	110.80
1804	48.09	172.43	5	113.13
1805	36.26	157.85	2	76.90
1806	42.06	159.96	2	96.14
1807	38.82	167.64	4	85.50
1808	36.87	142.18	0	78.31
1809	41.44	174.57	9	94.81
1810	31.71	134.52	0	62.62
1811	31.75	147.99	1	60.76
1812	32.07	148.95	1	61.61
1813	41.82	184.57	9	93.46
1814	48.97	172.24	3	119.82
1815	32.68	138.99	1	72.10
1816	31.47	138.43	1	66.54
1817	30.34	136.92	1	62.00
1818	32.17	136.73	1	70.47
1819	31.84	136.77	1	68.31
1820	28.45	135.28	1	55.06
1821	29.64	132.74	1	59.74
1822	27.06	134.50	1	56.62
1823	29.66	135.68	1	64.01
1824	27.39	135.78	1	51.46
1825	32.26	137.36	1	69.08
1826	32.05	136.77	1	69.04
1827	32.30	138.28	1	70.02

Appendix B

2001	29.98	141.14	0	59.39
2002	45.72	183.12	4	104.49
2003	24.30	144.41	1	45.55
2004	38.18	139.62	0	86.03
2005	27.39	135.78	1	51.44
2006	37.36	141.49	1	80.45
2007	30.79	128.58	0	59.81
2008	33.99	153.83	2	68.88
2009	40.50	178.37	5	89.19
2010	34.79	166.51	4	77.58
2011	34.81	139.55	1	76.57
2012	27.05	126.24	1	50.01
2013	30.12	142.86	1	58.69
2014	36.50	153.14	2	76.49
2015	27.01	141.47	1	51.90
2016	29.39	145.31	1	60.01
2017	33.97	153.84	2	68.86
2018	40.81	179.87	5	90.19
2019	25.86	124.37	0	49.35
2020	37.32	141.38	1	80.30
2022	39.72	141.90	0	94.04
2023	42.85	157.11	2	102.74
2024	30.86	130.87	0	59.01
2025	29.90	128.76	0	56.79
2026	29.00	131.05	1	55.11
2027	30.24	142.16	1	58.68
2028	24.25	131.87	1	44.58
2029	36.69	140.41	0	79.63
2030	41.60	172.40	3	91.55
2031	32.16	138.02	1	63.11
2032	38.88	160.66	3	89.38
2033	39.08	150.85	1	89.46
2034	39.63	145.57	2	93.43
2035	58.09	203.03	21	212.56
2036	28.59	136.21	1	56.16

Appendix B

2037	29.11	137.81	1	57.57
2038	37.51	167.22	5	84.96
2039	31.72	145.94	1	62.84
2040	30.16	136.39	1	59.32
2041	37.32	138.86	1	81.67
2042	30.61	131.26	1	59.29
2042	30.14	129.59	1	58.22
2043	28.66	133.45	1	55.96
2044	34.39	147.75	1	69.45
2045	29.28	128.85	1	55.33
2046	29.67	135.82	1	57.48
2046	29.62	134.07	1	57.32
2047	28.72	132.12	1	54.89
2048	26.99	133.44	1	50.75
2049	25.09	125.02	1	46.13
2050	28.28	134.93	1	52.81
2051	25.34	132.70	1	47.04
2052	26.06	130.41	1	48.24
2053	26.74	134.08	1	49.89
2054	26.17	130.58	1	48.89
2055	27.07	133.06	1	51.03
2056	28.56	133.52	1	53.81
2058	27.22	147.15	0	52.09
2059	26.56	147.97	0	50.21
2060	32.06	146.28	1	64.31
2061	32.03	150.46	1	63.23
2062	30.74	137.35	0	58.94
2063	34.97	139.50	0	72.47
2064	27.61	137.65	0	52.75
2065	31.02	133.94	0	61.15
2066	35.62	156.54	2	73.69
2067	34.46	151.91	1	71.17
2068	38.23	151.22	1	82.67
2069	37.34	152.27	1	78.47
2070	37.62	155.54	2	86.71

Appendix B

2071	43.91	164.55	3	99.17
2072	30.07	153.75	1	60.07
2073	43.18	167.52	5	94.62
2074	35.72	154.20	1	72.44
2075	38.42	153.98	1	80.24
2076	33.91	140.22	0	68.76
2077	32.39	143.88	0	63.67
2078	35.66	159.59	2	82.18
2079	30.85	160.68	2	65.85
2080	32.43	160.71	1	68.11
2081	31.85	155.87	1	67.44
2082	31.09	150.91	1	65.74
2083	27.74	148.31	1	54.19
2084	31.71	152.54	1	68.26
2085	29.51	146.98	1	60.13
2086	37.82	152.55	2	85.97
2087	32.09	163.48	2	68.75
2088	50.50	204.47	23	129.59
2089	30.54	145.37	1	63.24
2090	30.03	150.82	1	59.50
2091	26.90	147.80	1	51.56
2092	34.94	156.51	3	75.61
2093	29.72	155.11	1	61.82

